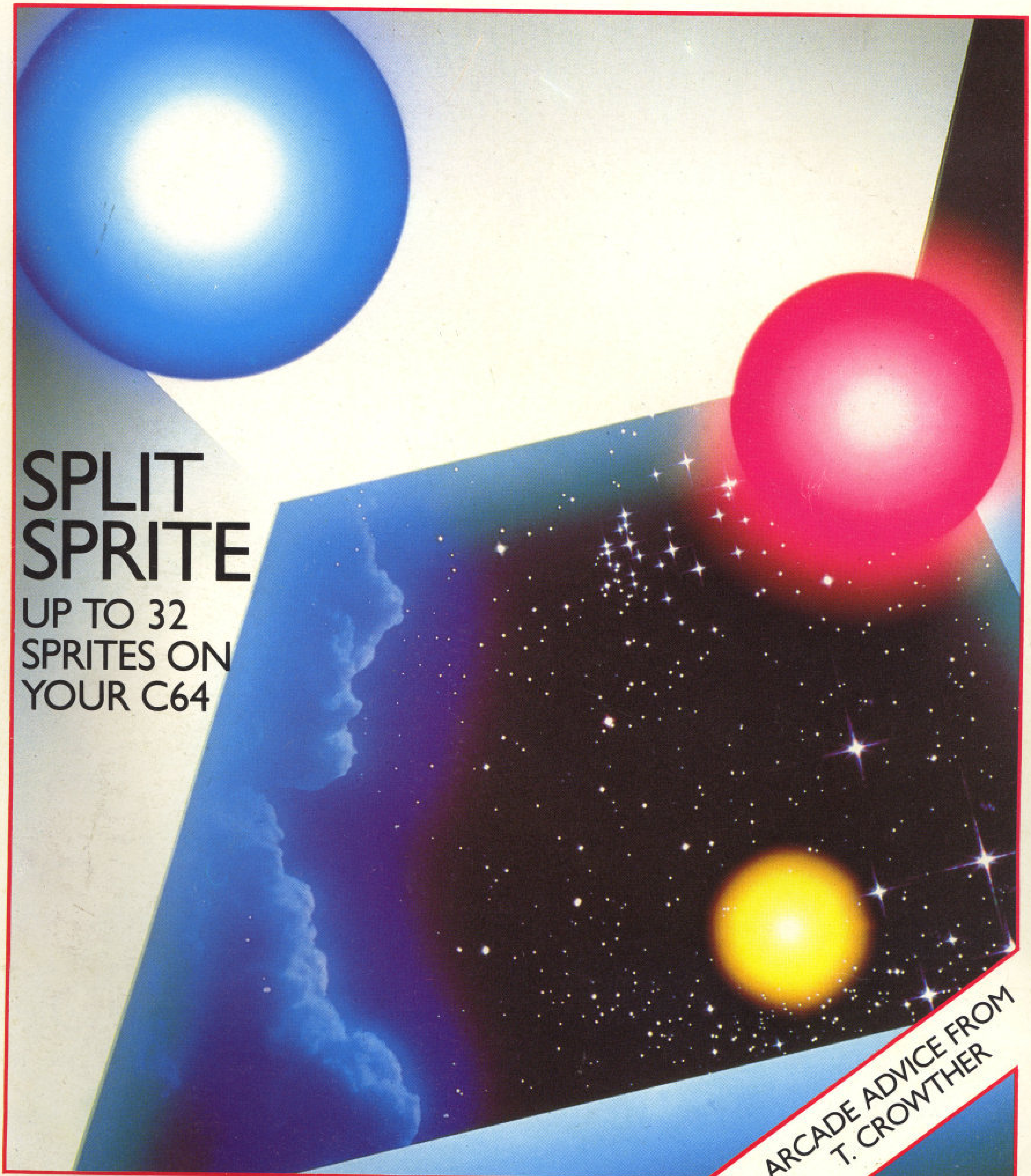
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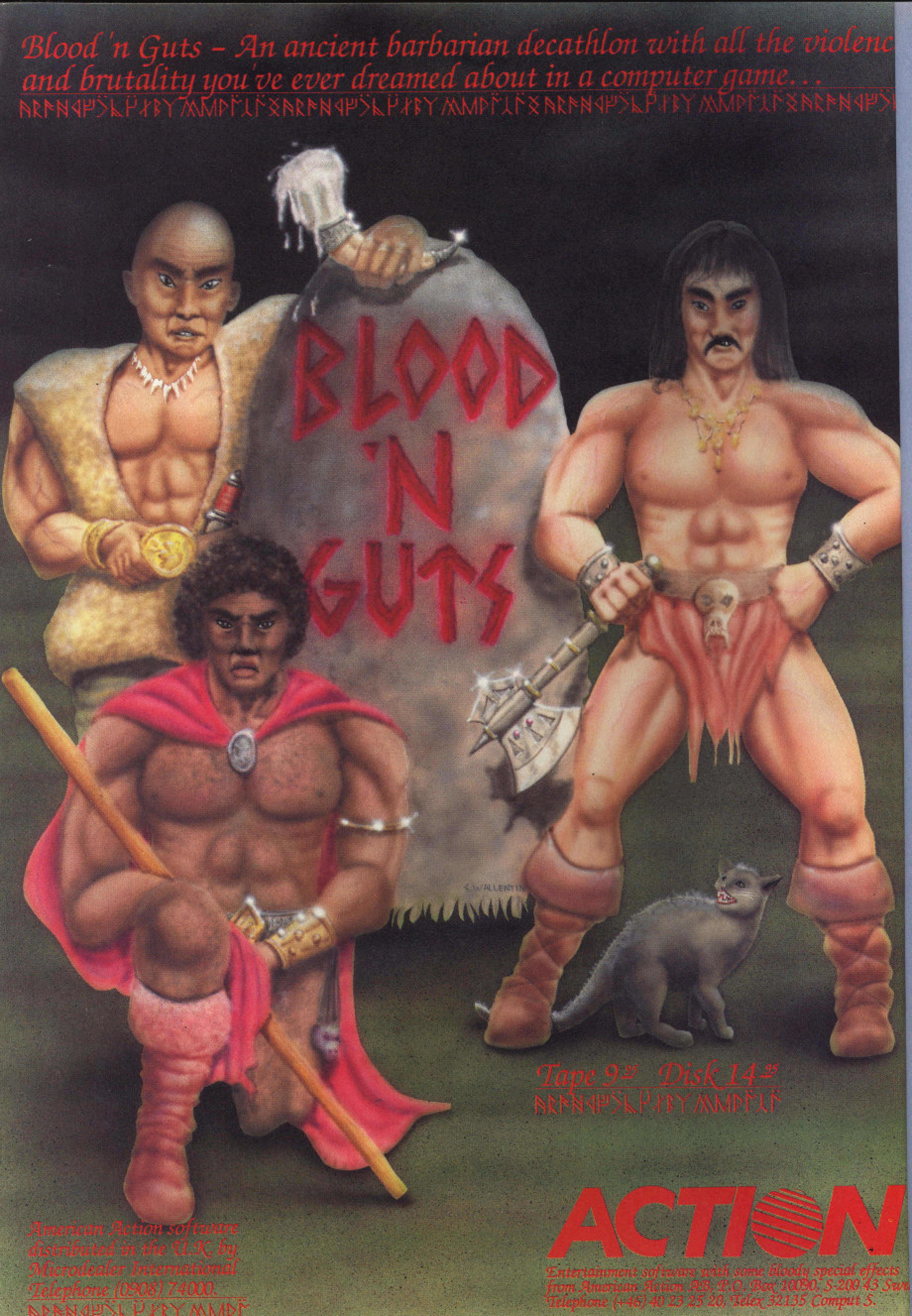
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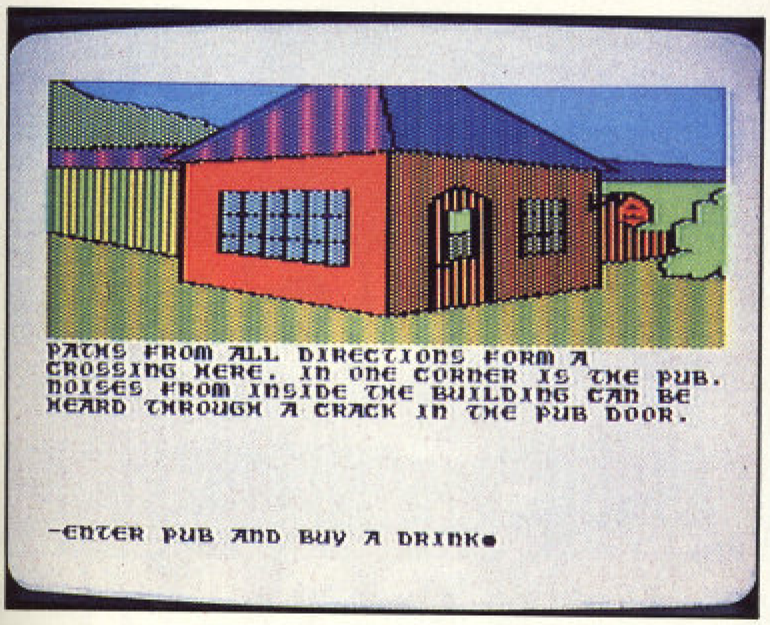
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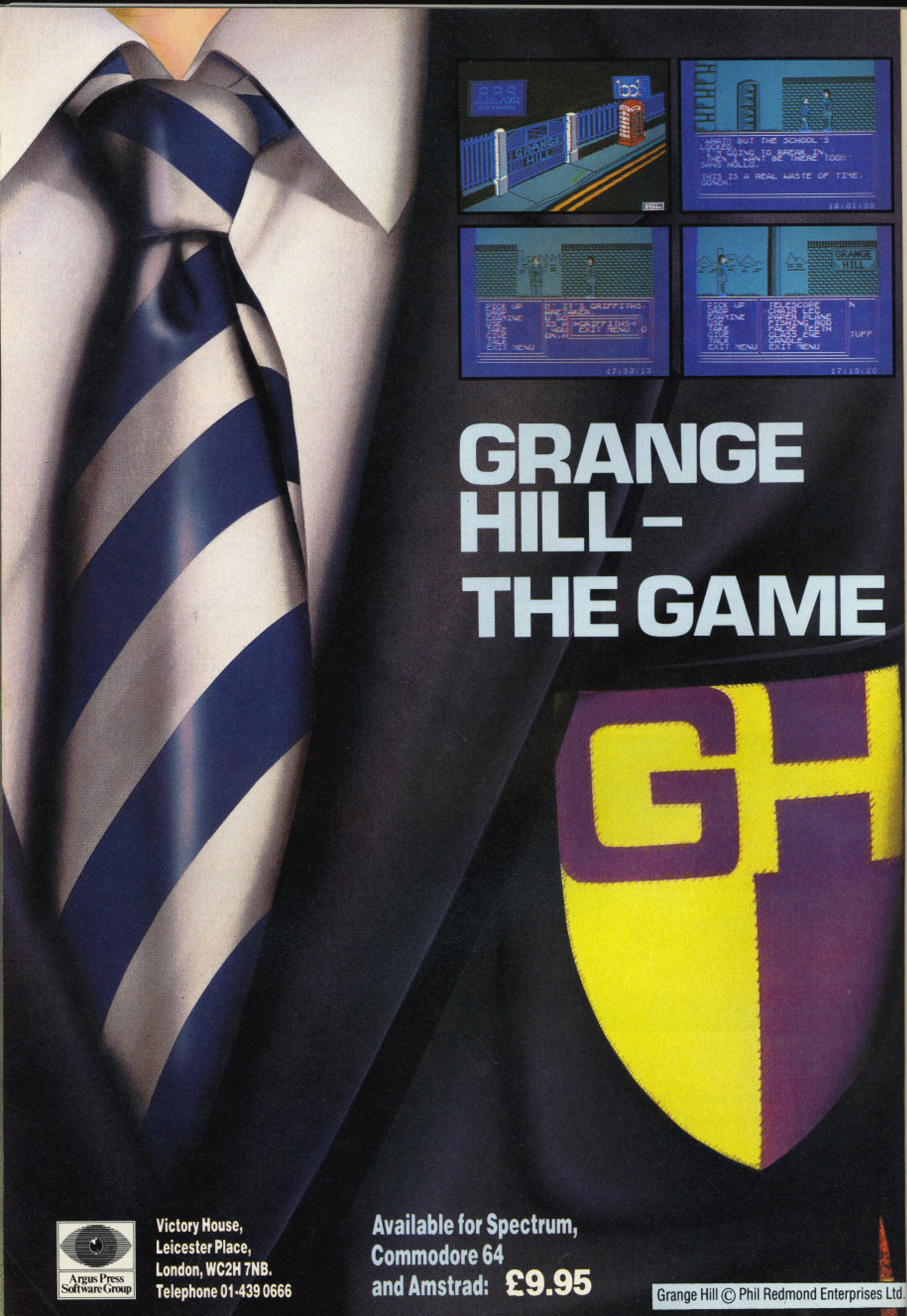
FEATURES





REGULARS

PROGRAMS AND UTILITIES



APS

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DATA STATEMENTS

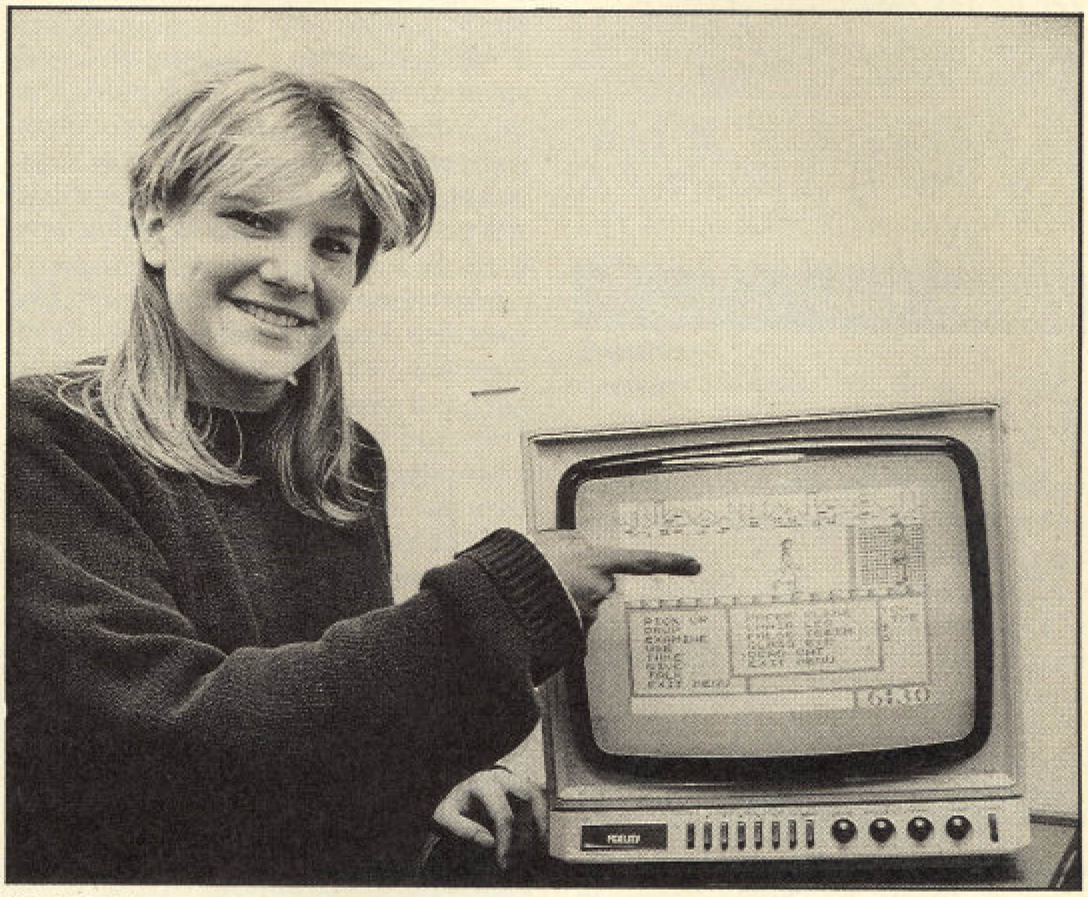
APS at School

Argus Press Software is soon to release the official Grange Hill game, entitled *Grange Hill – the Computer Game.* Spin off of the long running TV series about a comprehensive school, the game casts you in the part of Luke 'Gonch' Gardner.

The scenario is the darkened school, closed for the night. However, within the confines of the staff room, lies your Walkman, confiscated earlier during class. You cannot return without it for fear of the wrath of your mother. So, you have to get it back. What better idea than to break into the school after everyone else has left, find your way to the sfaffroom and claim your lost property? Well, it may sound a little far-fetched but that's the general idea.

With the aid of your pal, Hollo Holloway (presumably supporting this nickname because he has even less brains than you), you aim to complete your dirty deed by midnight otherwise your mum will go spare.

This adventure has a large number of locations and contains arcade elements as you guide the characters with the keyboard or joystick. It should be in the shops now and is



Bully Imelda

£9.95 on cassette.

Also look out for these other titles, coming soon on APS labels: *Wibstars, Agent Orange, Circus Maximus, World War One, Stellar Holocaust, Roundheads and The Hunt for Red October*, All are for the C64.

Touchline
Argus Press Software: *Victory House, Leicester Place, London WC2H 7NB.*
Tel: *01 439 0666.*

Miscellaneous Software

Finally a look at a few games winging their way to your local shops even as we speak.

Rainbird is releasing a new level 9 adventure for the C64 entitled *Knight Orc.* It casts you as an opressed orc intent on getting your own back on the humans who have subjugated your people for generations. State of the art digitised graphics are an impressive visual feature of the new adventure. Out soon.

Academy, from CRL, is due to be launched for the C64 in the spring. Continuing the theme of *Tau Ceti*, *Academy* enrolls you in the top secret training school of the Galcorp for skimmer pilots. You have to learn to design your own space ship, and participate in all the classes needed to qualify to become a full fledged skimmer pilot. It will be available on



cassette and disk at £8.95 and £14.95 respectively.

Airolasoft has a bargain package for the C16. *Void Runner and Hellgate* is a two-games-in-one cassette for only £6.95.

Also from Ariolasoft is *Killer Ring*, the latest Tony Crowther game on Commodore 64 cassette (£8.99) and disk (£12.99). The inlay card features a special recipe for K-Ring cup cakes.

Blitzkreig, a C64 game based on the Len Deighton thriller of the same name, will also be available for the C64 from Ariolasoft in the near future. Based on the assault against Britain in World War Two, you lead the German forces in a game of strategy and action.

C16 users are still being supported handsomely by Gremlin, and a new release for this machine is on its way to the shelves. *The Way of the Tiger*, based on the fighting fantasy series of books of the same name, combines strategy, action and unique animation. It features three action packed levels 'superb sound effects and inspiring backdrops'. Yours for £6.95.

Touchline
Rainbird: *First Floor, 74 New Oxford*

Street, London WC1A 1PS. ***Tel:*** *01 240 8838.*
CLR: *CLR House, 9 Kings Yard, Carpenters Road, London E15 2HD.* ***Tel:*** *01 533 2981.*
Ariolasoft: *68 Long Acre, Covent Garden, London WC2E 9JH.* ***Tel:*** *01 836 3411.*
Gremlin: *Alpha House, 10 Carvar Street, Sheffield S1 4FS.* ***Tel:*** *0742 753423.*

Links On Line

Who says computer owners aren't romantics at heart? News has recently come in of the first online engagement on *Compunet*.

The couple are Paul Hurrell and Margaret Northey. They were introduced by Carol, Margaret's mother. She said "I was chatting to Paul on Party-Line at Christmas and he sounded a bit down, so I brought Margaret online to cheer him up".

A five hour party line session lead to a phone call and then Paul made the journey from his home town in Winterbourne near Bristol, to Leeds, Margaret's home, where they met face to face for the first time. Soon afterwards Margaret surprised her family with a diamond and sapphire engagement ring. The couple plan to marry in about two years.

Margaret's father Chris said: "When I bought a modem, I didn't bargain for a wedding".

Paul summed up the couple's feelings about their romance: "It's thanks to *Compunet*. Living 240 miles apart, we'd never have met if it hadn't been for Party-Line".

On to the more serious aspect of communications, BT's *Electronic Yellow Pages (EYP)* went live in early January, allowing most online communicating terminals in the UK and abroad free access to a database of *Yellow Pages* advertisers.

Initial information covers the whole of London, Reading, Guildford, Watford and St Albans.

In areas where the 1987 edition of *Yellow Pages* are not available until later in the year, users interested should ring the *EYP* Helpline (see Touchline) for a free copy of the user instructions.

Touchline
Compunet: *01 965 8866.*
EYP Helpline: *0734 506259.*

Sports Pick

New from Activision is an America's Cup game, simply and appropriately tagged *Sailing*.

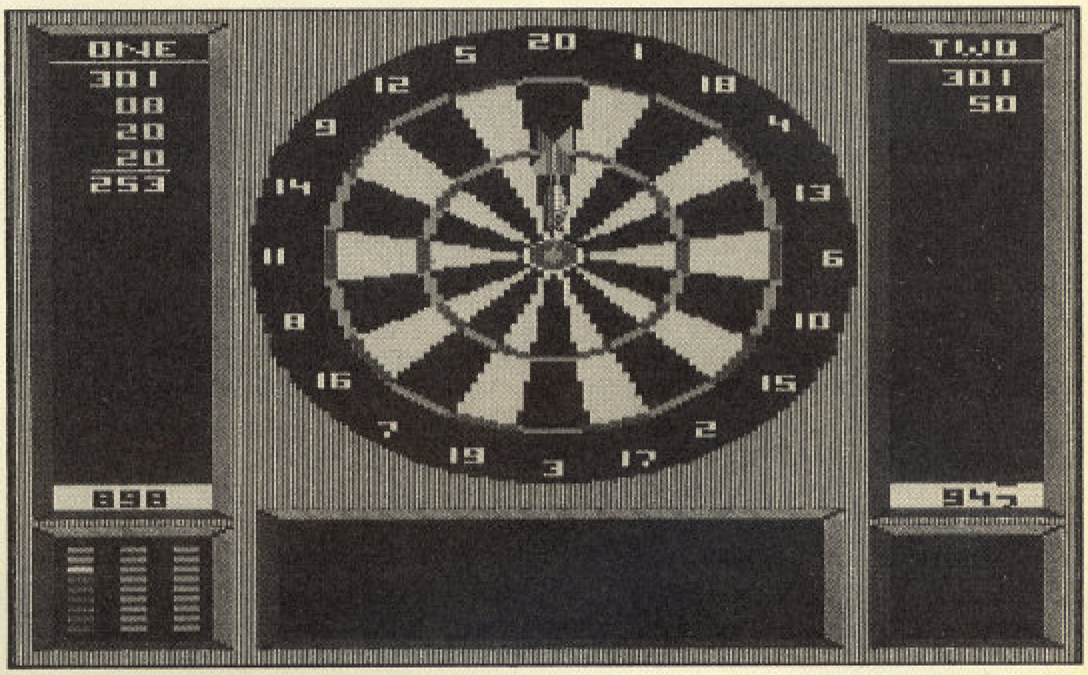
It's a game of strategy and simulation designed to capture the thrill of competing in top level sailing competitions. Even before you start racing you have to design the boat that wil get you across the finishing line first.

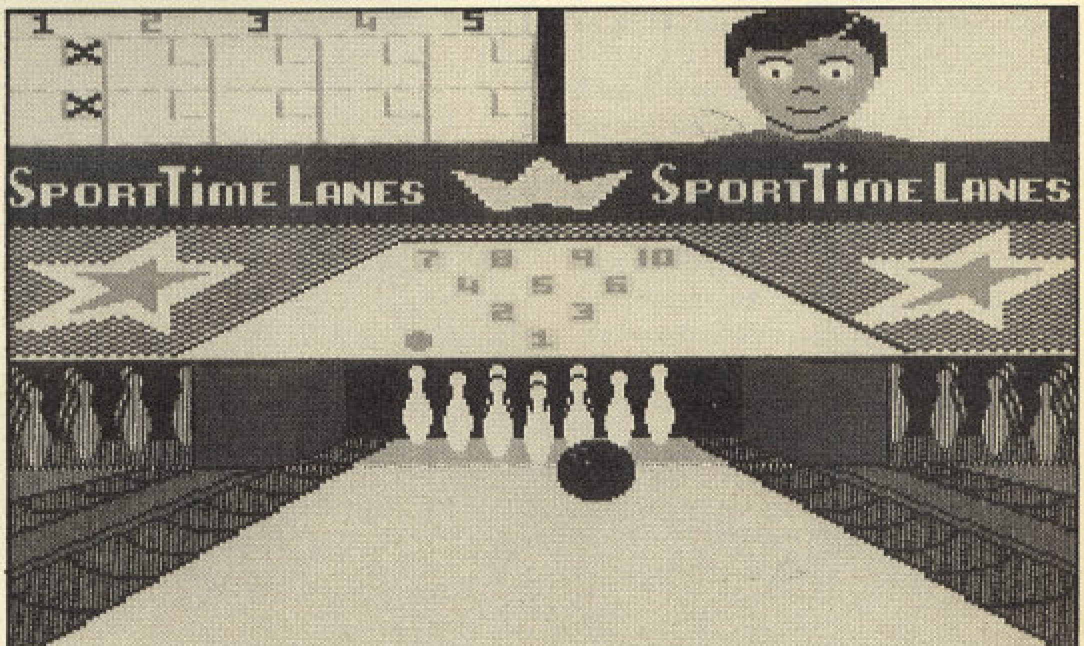
You can choose overall length, waterline length, freeboard and mast length as well as adding wings to your keel and changing the hull material. Once you've sorted this out and made your allegiance to a particular nation then you're ready to compete.

The display is spit into two halves, the top shows the prow out over the sea, so that you can see if your opponent is ahead. The bottom contains your gauges which you need to monitor closely to get the best from your boat. It's available for the C64/128 at £9.99 cassette and £14.95 disk.

Four sports games in one are available from Advance Promotions in the form of a new release entitled *Indoor Sports*. The four sports featured on the cassette for C64 are *10 Pin Bowling*, *Air Hockey*, *Table Tennis* and *Darts*. The Commodore 64 version is £8.95 and Advance claims that all the games could stand alone at full price.

Touchline
Activision: 23 Pond St, Hamspstead, London, NW3 2PN ***Tel:*** *01 431 1101*
Advance: *17 Staple Tye, Harlow, Essex CM18 7LX.* ***Tel:*** *0279 412441.*





Indoor Sports

Pocket Money

A new range of budget games has recently been launched by Midas Marketing. There are two initial releases on the new label: *X29 Fighter Mission* for the C64 and *Space 2* for the C16. Both are priced at £2.99.

X29 Fighter Mission is essentially a flight and combat simulator. Your fighter must be flown with skill and daring to avoid the constant onslaught of enemy fire and heat seeking missiles. At the same time you must concentrate on destroying the enemy craft.

Space 2 is a combination of shoot 'em up action and skill and nerve in manouevering a large space craft through dark caverns. There are two programs on *Space 2*. The first *Galaxy*, involves a lost starship trying to return to the mothership. However, there are the inevitable galactic mutations trying to hinder your journey.

Pilot X is the second program where you must guide your large fuel supply vessel to stranded scientists on the planet Vogon. They are situated deep underground so you need to negotiate the treacherous route through caverns strewn with strange obstacles.

Mastertronic is also launching a new lable named Bulldog (best of British).

The company claims to have commissioned some startling original products for the new label which will have a distinct identity to complement the existing Mastertronic £1.99 and £2.99 ranges. The first title, already in the shops, is *Feud*, at £1.99.

Recently formed Budget House, Code Masters, has just announced a competition for buyers of Code Masters games. Anyone buying a Codemasters game will get an entry form to the BMX competition. All you have to do is spot the fallen rider which has been deleted from a screen shot of the Code Master game *BMX Simulator*. Entries are only limited to the number of Code masters games you buy. Hurry, because the competition closes on 31 March 1987 and the prize is a 20" Sony Trinitron colour TV.

Other new pocket money priced games are *Willow Pattern* on the Firebird Silver £1.99 label and *Cyber 1* on the Supersparklers label from CDS at £2.99. Both are for the C64.

Touchline
Midas Marketing: *35 West Hill, Dartford, Kent DA1 2EL.* ***Tel:*** *0322 92513.*
Mastertronic: *8-10 Paul Street, London EC2A 4JH;.* ***Tel:*** *01 377 6880.*
Code Masters: *1 Beaumont Business Centre, Beaumont Close, Banbury, Oxon OX16 7RT.*
Firebird: *First Floor, 74 New Oxford Street, London, WC1A 1PS.* ***Tel:*** *01 240 8838.*
Supersparklers: *CDS, Unit B11, Armstrong Mall, Southwood Summit Centre, Southwood, Farnborough, Hands, GU14 0NP.* ***Tel:*** *0252 522200.*

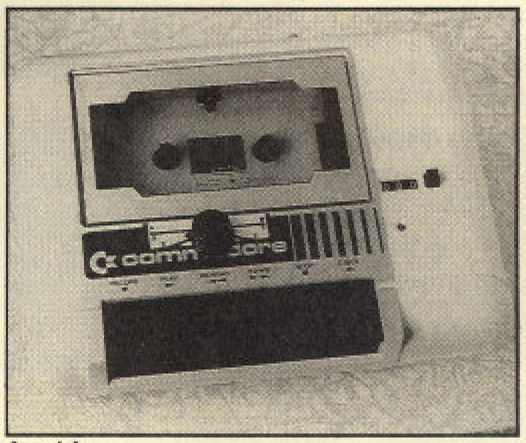
Drives and Data Recorders

The *Enhancer 2000*, the only available alternative to Commodore's own series of disk drives, although viable and reasonably priced, has always suffered from compatibility problems. Now Evesham Micros claims to have solved this.

Evesham claims that on the enhanced version of the *Enhancer*, all disk turbos and virtually all disk protection schemes can be handled without a problem.

Priced at £149.95 (fully inclusive) and an option to purchase with Freeze Frame Mk3b and 10 disks for £179.95, Evesham reports high demand from all quarters.

At the moment supply is restricted to mail order, unless you call in at one of Evesham's two branches. However, Evesham hopes to expand availability to other retailers in the near future.



Load-It

For those still struggling with data recorders, you may be interested in the *Load-It* system.

The system works in the following way: a small slot is cut in the case to allow the datafinder adjuster to move forward and backwards as play and stop are requested. A knob is attached to a threaded shaft which replaces the azimuth screw allowing an adjustment of 180 degrees. Sound is also fitted for the Commodore 64 allowing the user to adjust to the clearest data signal. For the technically minded there is a DIY kit available. If you're interested, then contact the address in Touchline for more information.

Touchline
Evesham Micros: *63 Bridge Street, Evesham, Worcs WR11 4SF.* ***Tel:*** *0386 41989.*
Load-It: *35 Stretton Road, Shirley, Solihull, W Midlands B90 2RX.* ***Tel:*** *021 745 4970.*

Notes on Utilities

Supersoft, the company which has ardently supported the PET series from the beginning, has now fulfilled a recent promise to continue to provide software for these machines.

Fast Copy is a disk copying facility for the 8050 and 8250 drives which can drastically reduce the time it takes to make vital check-up copies of data disks. It saves time by omitting the formatting process on an already formatted disk and by copying only those blocks that have been used. Available at the low cost of £15 (ex VAT).

Blitz is a Basic compiler for the 3032, 4032, 8096 and 8296 computers. *Blitz* has been available in Europe for some time and has now been licensed to Supersoft in the UK. Compiled programs run five, 10 or even 20 times faster with *Blitz* and since they are impossible to alter by anyone who hasn't got access to the uncompiled original, they are also more secure.

Blitz costs £99 (ex VAT) and comes with a comprehensive manual. Additional versions on the same disk are only £30 extra, so for example the 8032 and 8096/8296 version would be £129 altogether.

Fast Copy and *Blitz* are available from Supersoft or on order from your local computer store.

Staying with utilities but moving to

the C64, Systems Software has recently published *Oxford Basic*. This is a complete C64 Basic programming environment and gives the user a full library of powerful utilities including: *Oxford Analyzer*, a report optimisation utility; the *Compressor* which eliminates time consuming spaces and REM, the *Toolkit* which introduces new commands; *Ox-Comp* a fast fully compatible Basic compiler to give you the speed and professionalism of machine code without an assembler. The all-inclusive price is £34.95.

Touchline
Supersoft: *Winchester House, Canning Road, Wealstone, Harrow, Middz HA3 7SJ.* ***Tel:*** *01 861 1166.*
Systems Software: *16B Worcester Place, Oxford, OX1 2JW.* ***Tel:*** *0865 54195.*

Potential Millionaires Wanted

American software company MicroProse, which has recently established a UK base, is looking for Commodore software writers with the potential to become millionaires overnight.

The man behind the hunt is Simon Barnard, MicroProse software development manager. He said: "We believe that the UK has the best Commodore software writers. And my job is to find them and offer them, not only money, but international recognition".

MicroProse in the US spends in excess of $1 million in developing its software programs. However, Simon is not just looking for simulation specialists, he also wants programmers of top quality arcade games.

Simon revealed his reasons for believing that successful applicants may soon gain millionaire status: "MicroProse titles remain at the top of the US charts, literally for years. And that translates into a lot of royalties, besides substantial advances. So I don't think it would be unfair to claim that if we can find someone who can write simulation like Silent Service, they could be a millionaire almost overnight".

MicroProse has an extensive list of simulation programs, the latest of these, due for imminent release, is *Gunship* for the C64/128, £14.95 cassette, £19.95 disk.

Gunship is an accurate simulation of the Hughes AH-64A Apache combat helicopter – one of the most lethal weapons in the modern military arsenal.

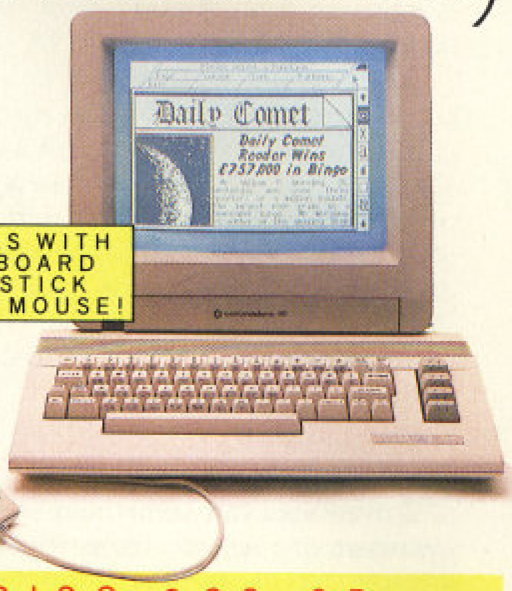
Gunship is the result of extensive research and the culmination of five man years of programming and games design. It was held back from release until military helicopter pilots had actually test flown *Gunship* themselves. Now the US army uses it to stress test pilots, attaching sensors to their bodies to measure reactions. YC

Touchline
MicroProse: *2 Market Place, Tetbury, Gloucestershire GL8 8AD.* ***Tel:*** *0666 54326.*

Stop Press! What's so special about The Amiga, The Mac, The Atari St., Windows and Gem?

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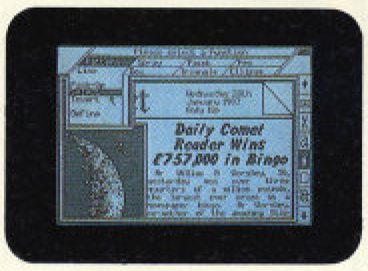
There's not much joy in a joystick and keyboards can be all fingers and thumbs. Acclaimed by the press as 'the best input device', already over 50,000 micro users have adopted an AMX Mouse. The AMX Mouse combined with Stop Press puts you right at the heart of the desktop publishing revolution.

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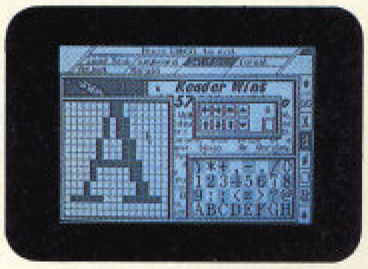
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Provides easy access to all the 'Stop Press' modes. A comprehensive and versatile filing system that makes management a joy! Powerful graphic and full proportional text options enable you to give your documents the professional look with the minimum of effort. Allows windowing, copying, re-scaling, and all the printer options at the touch of a button.



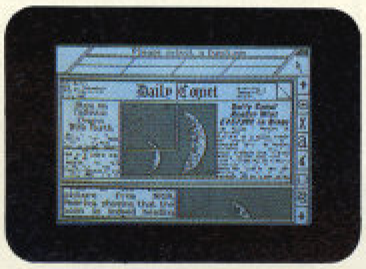
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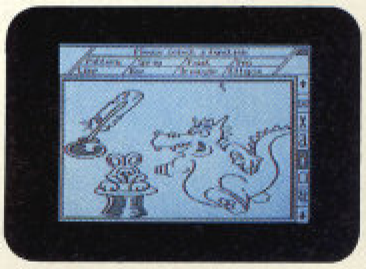
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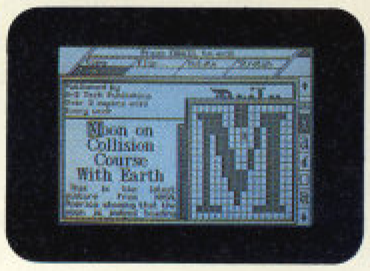
CLIP ART

Over 150K of clip-art is supplied with 'Stop Press' covering a wide variety of subjects including sport, music, transport, cartoons, technology, and a host of miscellaneous items. Alternatively areas of your page can be "cut" to disc, building into your own unique library of clip-art. Cut-outs can be "pasted" into any page, at any position, preventing the need to re-do headers and footers, etc.



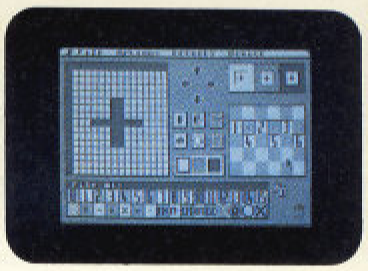
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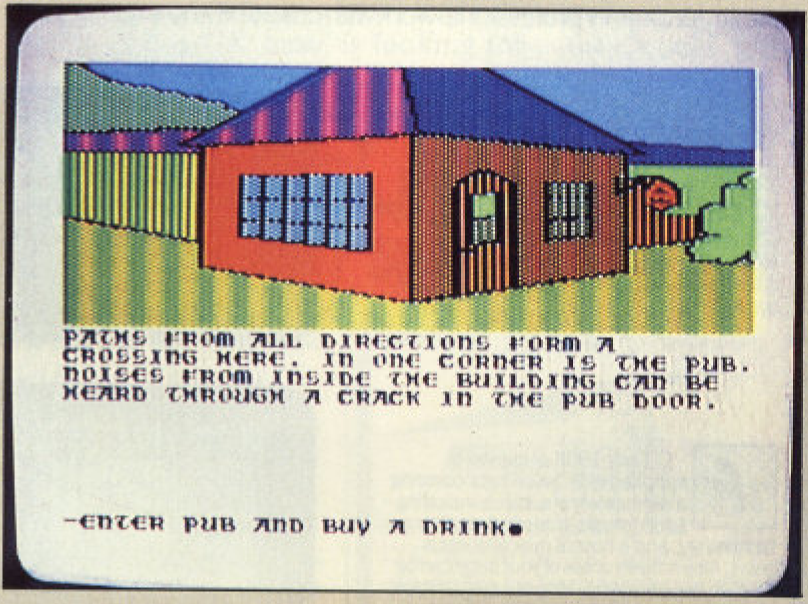
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TUBELINK ON PRESTEL PAGE 2582182 SUPPORTS THE AMX MOUSE AND ALL AMS SOFTWARE

I.Q.

More and more people are turning to games which need grey matter rather than thumb power on a joystick. Here's another exciting selection to tax your mind.

Adventures can sometimes seem rather daunting to the uninitiated. Apart from the necessity of learning adventurespeak and the all important mapping technique, there's the bigger problem of mind bending puzzles to solve. All this could easily turn away the average punter, however we've decided to have a look at a couple of programs from Ariolasoft which may help to break you in gently so that you can cultivate the adventure bug.



THE PHILOSOPHER'S STONE

Commodore machines aren't the exclusive preserve of Britishers and our US Buddies. Europe is a hotbed of Commodore enthusiasm and Germany is perhaps the heart of this trend. It is fitting then that this game from Ariolasoft originally started life there. Actually called *Lapis Philosophorum*, but translated for non-classicists, this is an ideal starting point for new adventures and an interesting diversion for more experienced addicts, unfortunately only available for C64 and 128 disk users.

The basic storyline concerns a medieval king, Hight Gieselmer, whose stepson has been systematically poisoning him. The only hope left to the old boy is the Philosopher's Stone which has the fantastic powers of turning base metals into gold and curing all ills to boot.

Your character is that of an ageing alchemist. You have found clues to the whereabouts of the fabulous stone in a book in your loft (where else?). So you set out to get hold of it. Make sure that you explore your home town thoroughly first. Leaving town may be a problem as the prince has discovered the nature of your quest and the guards are ordered to detain you, however, with the right object you can hypnotise them into letting you pass.

One distinct advantage for new initiates are the HELP messages placed in strategic parts of the game. Heed them well as these cryptic clues may prove invaluable.

Most items which are available are included in the location description, however, if you go to the market there's more choice but you have to think hard about what you may need later on. Remember to SAVE your game position in the early stages so that you can go back for anything you may have omitted to collect.

The graphics are clear, colourful and reasonably detailed. Disk access is at the usual slow speed.

If you are moving between locations the format N,N,W,N,N,E,GET STICK can speed up progress. The interpreter understands basic verb/noun formations but on occasion a little more detail may be needed. One retrograde aspect is the necessity to enter all words in full with very few single letter entries understood. Two that you can use are I for Inventory and L for look to repeat a location description.

There is no RAM SAVE facility but there are seven named positions saved to disk. You will need these as in several places death will follow the wrong move, for instance if you lose a game of Hangman with a troll!

Although a most enjoyable game with lots to find and plenty of puzzles to solve. There are said to be seven different ways to complete the game so perhaps experienced players will appreciate that challenge. Definitely fun for all levels of player.

P.F.

NECRIS DOME

Due to limitations of room and resources, the Earth's dead are no longer buried or cremated as used to happen, but are transported into orbit. There, a huge space cemetery called the Necris Dome circles around. Run by a group of mandroids, they in turn are controlled by an Arch-mandroid who is rumoured to be trying to create something of a powerbase for himself.

As weapons have been banned on Earth for a few

centuries, it is really bad news when it is discovered that the Arch-mandroid has filled the Necris Dome with various potential forces and get smuggled into the dome in the next batch of coffins. Your mission is to seek out and destroy the Arch-mandroid at all costs.

Necris Dome is a somewhat simplistic adventure which starts with you in your coffin. The first illogicality strikes you straight away. Although you can see nothing in the coffin either now or when you open it, if you return to the coffin and close the lid, a pair of rubber gloves has mysteriously materialised. Nothing is guaranteed to put off an adventure player (or at least this reviewer) than such nonsense.



The atmosphere created by the game is minimal. Location descriptions are terse – 'you are in the reception level chamber three as opposed to chamber two or four. The graphics likewise have a feeling of similarity to them. Even at a budget price, I cannot recommend Necris Dome. **G.R.H.**

As promised in our I.Q. pages, we're not just trying to publish a run of the mill adventure column, so for those of you who want something a bit different, read on to check out some other original games.

TASS TIMES

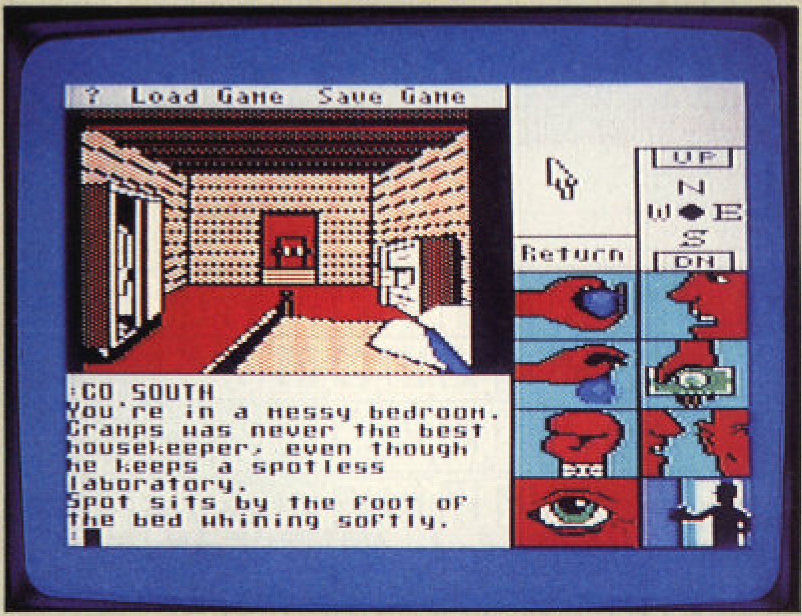
If your idea of style is a infra red dimmer switch then you'll relish this ludicrous graphic adventure from Activision.

The game is set in the ultra tass (trendy) world of Tonetown that exists in another dimension. Your favourite old fogey, Gramps has built an inter-dimensional machine and has got himself lost in Tonetown and it's up to you to find him. Helped by Gramp's dog Spot who is really Ennio the Legend in Tonetown you must search this strange land trying not to look too much like a total tourist.

There's nothing weird about the excellent adventure system used to play this game. The screen display is split into areas including a graphic display of your current location, a text display (for text only freaks) and alongside them a series of large icons through which you can quickly generate the commands look, enter, hit, buy, get, drop, talk to, tell me about as well as north, south, east, west, up and down. You can also enter standard text commands use the predefined function keys to repeat commands and quicksave and load game positions. You can even examine and get objects illustrated in the pictures by simply pointing a cursor at them!

The villain of Tonetown is an ugly green brute called Franklin Snarl who would love to get his claws on you in between his attempts to buy up the town. His antics to date and other essential clues are packed into the latest edition of the Tonetown Times that also includes adverts that will help you become tass and the usual collection of curious small ads.

Tass Times is undoubtably a unique adventure featuring the most peculiar settings, characters and descriptions but it is also very good and will be Activision's best non Infocom adventure. Remember Tonetown welcomes visitors but not total tourists. **T.H.**



THE STANDING STONES

This is the second Ariolasoft title which holds a challenge for the beginner without being too complicated. Set in the ground beneath an ancient stone circle, the idea is to locate the long, lost Holy Grail.

When you begin play you must create a knight. Go carefully here, as it is important. A list of attributes appears with random ratings of up to 18. If you don't like the numbers assigned, you can try again. The instructions suggest that you only accept a character with at least three attributes in double figures. In which case, why do they give so many with less than 10? The attributes are: virility, intellect, holiness, agility, and initial hits. These can be roughly translated as strength, magical attack, peaceful spells (such as 'heal' and 'teleport'), agility is self explanatory and initial hits indicates your ability to withstand attack.

Once you've settled your character, it's time to enter the 3D maze, where you must explore, fight monsters and collect treasure.

The maze must be mapped for you to stand any chance of success. On the first level a series of arrows points the way to the exit. It is best to use this over and over again so that you build up your experience. Leave it at your peril.

Apart from the monsters there are many useful items, including magical books, chests, potions, rings, weapons and armour. Unfortunately many of these articles are booby-trapped so it's not all plain sailing.

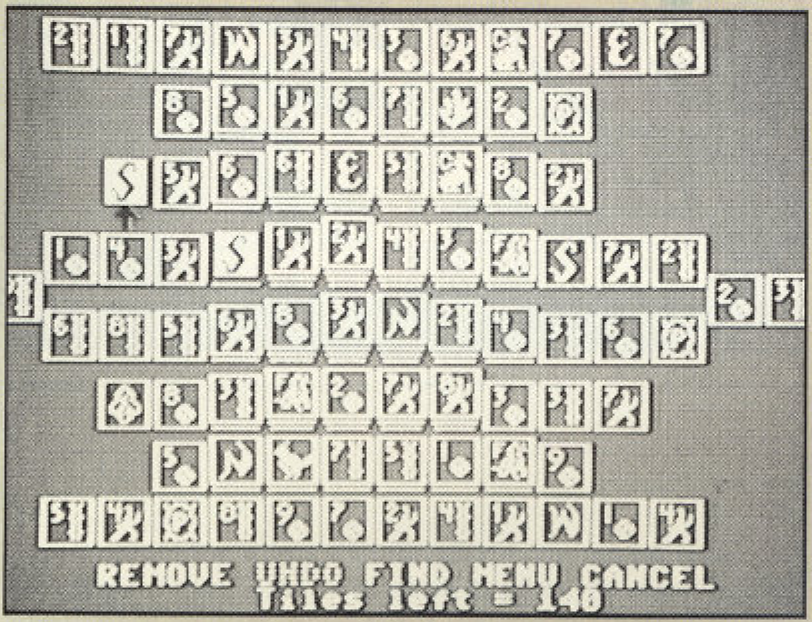
When you encounter a monster you have several courses of action: fight, greet, bribe or run away. Fighting is usually the best option, however, elves and gnomes will sometimes return a greeting and gives you a gift as well.

Throughout your quest you have a companion named Lancelot. Most of the time he is snoozing or sharpening his sword but ocassionally he bursts into action and despatches your present foes.

The deeper you go the harder the game becomes. Further down there are oases which will restore drained strength but they're not always in the same place.

The graphics consist of simple line drawings for the maze and fairly basic shapes for the enemies. You may leave the dungeons at any time to save your character.

Not a bad game if you choose your character carefully before testing the depths. Even then you should not expect to stay alive long unless you map your route and this can be difficult due to secret doors and one way passages. *The Standing Stones* calls for a lot of patience, a will to live and a lot of luck. P.F.



SHANGHAI

A variation of the card game pairs doesn't sound like the usual fodder for a computer game but it's surprisingly addictive.

This variation uses the 144 tiles found in a Mah Jongg set (the ancient Chinese game) arranged in a set pattern that is supposed to represent a dragon. The pattern rises in the middle to a height of five pieces (the head) and down to rows of single tiles.

To complete pairs that are then removed from the game the player can only match tiles that aren't surrounded by others which usually means from the head and tail. By this method you must try and remove all of the tiles or at least as many as possible either on your own, in solitaire play or against other humans in a tournament game against the clock.

Matching pairs can be a strain on the eyes as you stare into the screen at an average of 80 tiles that are in view for most of the game. The others are hidden from view in the piles in the centre of the pattern which you must gradually whittle down.

Mah Jongg sets contain 144 tiles split into three major suits and craks, bams and spots (also known as characters, bamboos and circles) three dragons, four winds and an odd collection of flowers and seasons. As there are four of each piece you would think that matching pairs would be easy but you'd be surprised at the number of times you'll have a choice between three pieces and have to work out which one to leave.

Options at the bottom of the screen allow you to undo moves you want to play again and even peek at hidden tiles once you've given in.

At last an addictive strategy game. T.H.

DODGY GEEZERS

The big day has arrived. Your stay, courtesy of Her Majesty is about to end. It was only supposed to be for two years, but you got time added on for bad behaviour. You have been looking forward to this day for some three years now, not least because you have a small amount of unfinished business to attend to. You were stitched up something rotten over that Long Ditton Spaghetti caper and a spot of revenge would not go amiss.

Dodger Geezers is an adventure in two parts. In part one, you must find a crime to commit and assemble a team to help you do it. Part two involves pulling off the actual crime. The game is set in the East End of London, presumably because everybody knows that that is where all the real criminals hang out. There is the usual collection of misfits as you make your way round dark alleys, seeding pubs, a dockland area and the dog track. Crimes are being committed all round you, judging from the number of wanted posters about, but can you actually find the men required for your team? And who is the shadowy figure with the white Gucci shoes who turns up everywhere? And why are there several crates hidden in the warehouse full of two inch nails when they are clearly marked Banco di Palmermo? All you have to go on is a telephone number from a colleague who was released on the same day as you. All you want now is a working phone.

Dodgy Geezers is a reasonable enough game without being outstanding. The parser is fairly crude, being for the most part verb/noun input. There are a few spot graphics, usually the wanted posters which brighten the place up but the gangland atmosphere and jokes don't quite work. G.R.H.

Touchline

Philosopher's Stone, Standing Stones: *Ariolasoft, 68 Long Acre, Covent Garden, London WC2E 9JH.*
Necris Dome: *Code Masters, 1 Beaumont Business Centre, Beaumont Close, Banbury, Oxon OX16 7RT.*
Tass Times, Shanghai: *Activision, 23 Pond Street, London NW3 2PN.*
Dodgy Geezers: *Melbourne House, 60 High Street, Hampton Wick, Kingston-upon-Thames, Surrey KT1 4DB.* YC



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Football Fortunes

Polish up your footie boots, get your mum to wash your strip and sit down to a game of soccer with Brian Clough.

By Tony Hetherington

Brian Clough has always been known as an unusual football manager. Now the game that carries his name is a computer game with a big difference because it's also a board game!

Inside a packed video size cassette box is the game tape or disk, a folded game board, five coloured counters, 112 player cards, immunity cards and a heap of game money and, of course, an extensive instruction leaflet. As the game loads the players just have time to set out the board, cards and pieces and sign up as a top manager in a super league of 10 teams. Between two and five teams can be managed by humans the rest are controlled by computer and one of four skill levels. There's no great mystery here, the higher the skill level the stronger the computer teams that you'll face.

In fact the whole game is remarkably simple and after only a few fixtures you'll be wheeling and dealing with the best of them. Indeed the hardest part of the entire game is persuading the game board to stay flat after being folded up inside the box.

Once the game has loaded you have to choose your team from the list available or you can overwright one if your favourite's not included in the initial line up. After a brief pause, the computer displays the line up for each team in turn including two reserves. This line up consists of a series of numbers, between one and five that represent the skill levels of your goalkeeper, defenders, midfielders and attackers that form your initial squad of players. You then take the corresponding cards from the pack of playing cards to start the game. These cards also feature names for every player that are sure to cause rows particularly if you're favourite's only a level one and not an international standard level five. The names aren't important to the game but vital to football fanatics so a few blank cards are included to correct these "mistakes".





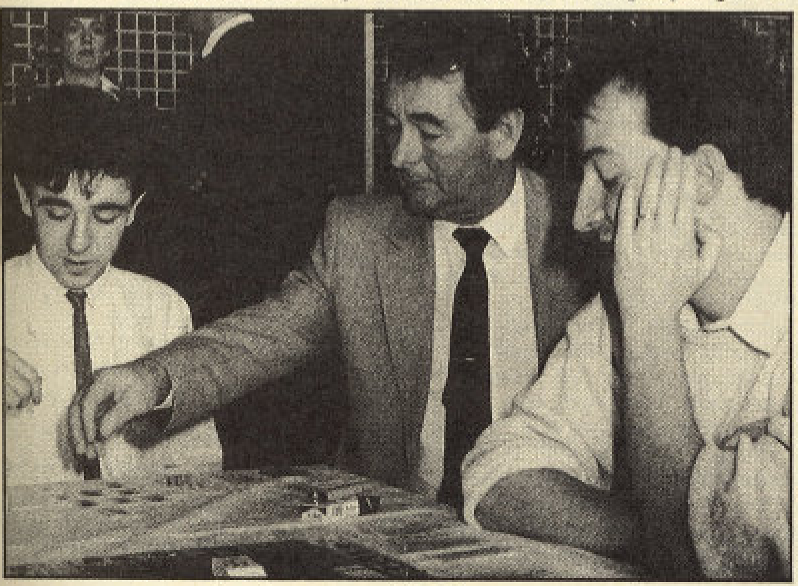
The game plays as alternate rounds of moving the pieces around the board and football fixtures on the computer although the computer is active throughout.

By throwing the computer dice players move their counters around and land on squares that contain the problems and crises that make up a manager's job. These range from the Manager's Luck and Selection Problem Cards that are displayed randomly on the computer screen to the dreaded Wages that are paid out and depend on the size and skill levels of your squad.

The Managers Luck cards are a bit of a lottery and can cost you £85,000 to install astro-turf or gain you £100,000 by

selling the reserves' training ground. The same is true of the Selection Problems cards but most are bad news and can cost you a crucial player for a match through injury or suspension but the occasional one may get you a free transfer.

The most exciting squares generate player auctions in which the managers bid for the next card jin the player pack.



At some stages in the game bidding can get desperate as players out bid each other particularly if a level five player is involved. Occasionally a manager gains the advantage if he lands on a 50% Auction square as he only has to pay half of his final bid!

Before each match the players must enter their total attack and defence strengths that are calculated from their selection card team. A few seconds later having contemplated these and factors such as home advantage and league position the C64 teletype displays the results jand the gate money that the players receive.

The season consists of only nine matches as each team plays each other but also includes FA Cup matches featuring giant killers such as Yeovil Town, and, from the second season European matches, although your squad has to be good to live with the likes of Bayern Munich and Juventus.

Throughout the game your achievements and results are noted and are converted into game points and at the predetermined end (a number of seasons or a time limit) the player with most game points will be "over the moon" as he has won the game.

One final piece of advice is keep off the Crisis Square! This suicide space (renamed the "sick as a parrot" square) costs you £50,000 and your best player!

A fascinating mix of computer strategy and board game fun that combine to form the football favourite. YC

Touchline

Title: *Brian Clough's Football Fortunes.* ***Supplier:*** *CDS Software, CDS House, Beckett Road, Doncaster, DN2 4AD.* ***Machine:*** *C64.* ***Price:*** *£14.95 (tape) £17.95 (disk).* ***Originality:*** *8/10.* ***Playability:*** *10/10.* ***Graphics:*** *N/A.* ***Value:*** *10/10.*

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Shepherd's View

Nigel Shepherd, boss of Commodore US, explained his recipe for Commodore's future success to our globe trotting reporter.

By Peter Chandler

In this business, shows are always worth a look since they provide a general gathering of the big wigs of our industry. The CES Show in Las Vegas in January was no exception, and that's where I managed to track down Nigel Shepherd, General Manager of Commodore North America, ensconced in the splendour of Commodore's stand.

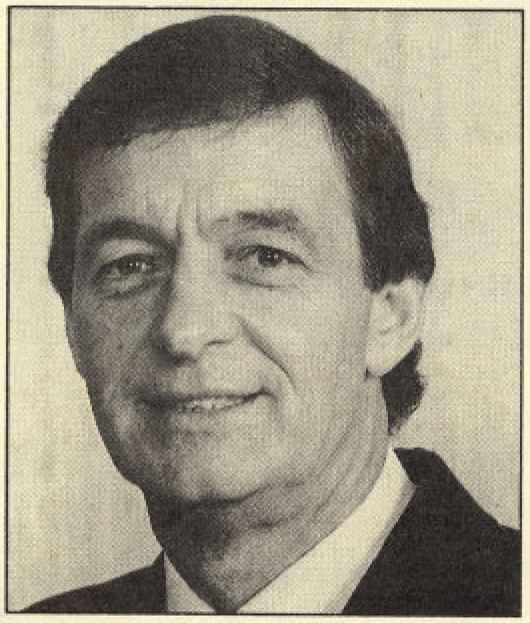
The Venue

The CES Exhibition is held twice a year in the USA. The summer show is staged in Chicago and the winter extravaganza takes place in Las Vegas. It was to the latter venue that I wended my way this year.

The Las Vegas show is the largest of its kind in the world and this year's event was no exception with a record attendance of over 100,000 visitors. The show is open only to trade visitors, made up largely of representatives from retailers, manufacturers and the media, pouring in from the USA and all over the world. Exhibitors consisted mainly of audio, video, satellite, photographics and most importantly from my point of view, computer companies.

There were four venues: the Las Vegas Hilton, the Convention Centre, the Sahara Hotel and the Riviera Hotel. The home computer companies were all based in the West Hall, a huge building which is just one of many which form the Convention Centre.

Commodore was there in force and exhibited its products from a massive and very impressive stand. It was a heartening sight to see Commodore taking such an aggressive approach at the largest show of its kind in the world. Commodore launched three C64/128 products at the show: the



Nigel Shepherd

1581 3½" disk drive, 1764 RAM Expansion card and the 1351 mouse. A number of software companies were exhibiting from the stand including Byte to Byte, Quantum and Anakin Research.

The Man Himself

Nigel Shepherd, a man of presence, very charming and charismatic, is the General Manager of Commodore US and North America. He reports directly to Tom Rattigan, President and Chief Executive Officer of Commodore USA. The other individual in the sales and marketing hierarchy who also reports direct to the President is Harold Speyer, based in Frankfurt, Germany and responsible for European operations.

Nigel Shepherd is Scots by birth and Australian by commerce and has been involved with Commodore since 1977. Initially as an Australian Commodore distributor, Commodore later set up an Australian subsidiary and in 1979 Nigel Shepherd became the General Manager for the Asia Pacific Region (all countries from Australia to Hong Kong). In January 1986, he moved to the US to take over North American responsibilities.

Tripartite Aims

Nigel Shepherd sees Commodore as active in three sections of the computer industry.

Firstly, he sums up the C64/128 as the "classic definition of the home computer". His authoratative view is that 90% of all C64/128 purchasers are first time buyers, also many 128 buyers are people upgrading from a C64.

He also sees Commodore playing an important role in the large educational market in the US particularly in the primary school sector known in the States as K1 to K12. To back this up Nigel also reminded me that in the USA, Germany and Australian markets Commodore are leaders with the C64/128 in home computers. He sees the C64/128 as a common product line which will be around in 1990 and Commodore will continue to support the machines with peripherals software etc.

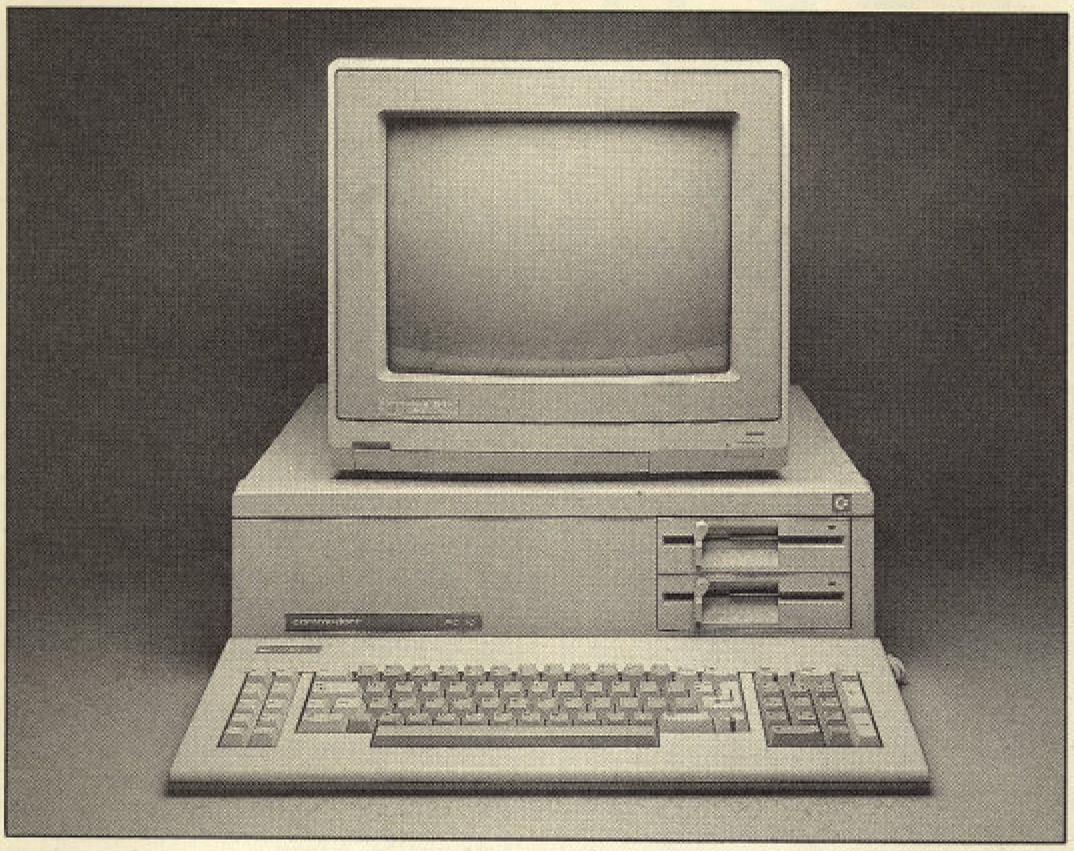
The much appraised Amiga machine, only recently launched, is seen by Nigel as the future of Commodore both in the home and business markets.

Being Frank, Nigel commented that: "probably the single largest criticism aimed at the Amiga is that the consumer is unsure whether or not the machine is for the home or is a desk top computer – a computer too highly priced to be accepted as a home computer and the lack of productivity software makes it difficult to accept it as a business machine."

Commodore's answer to this criticism is to launch three different versions of the Amiga and attack both home and business markets in terms of price and quality.

Nigel explained that the first version, the Amiga 1000, has fantastic user loyalty and it will be followed in the next few months by two new Amigas the 500 and the 2000 to expand the product line.

Nigel explained the thinking behind this strategy. He envisages that the C64/128 will be purchased as a family machine by first time buyers with a main use for children aged five to 12 years old. The machine is not too expensive but Commodore cannot be sure that the family will continue to use it. The answer to upgrading combined with continued brand loyalty is the Amiga 500 – the low cost version, described by the enthusiastic General Manager as "the ultimate home computer". On top of this the high demand for computer learning will continue and there is still a great demand for productivity software. The buyer who has grown up with a C64 or even a Spectrum, and is looking for a second purchase will appreciate better sound, graphics and top class games – Amiga technology lends itself to this market.



CBM's IBM clone

2000 Amiga

The 2000 Amiga will be a desk top or business computer and will also be the home overlap machine. Nigel Shepherd believes that "the home is a location". Although traditionally used for learning and entertainment, many small businesses are run from domestic locations as cottage industries. The 2000 will lend itself both to the home/office and true business application.

As we go to press, both the 500 and the 2000 are scheduled for launch in the Hanover Fair in Germany at the end of March.

Nigel also sees the Amiga gaining acceptance in tertiary education. He claims that it is ideal for universities as its price combined with its sound and graphics capabilities are not found elsewhere. He quickly pointed out that the Apple Mac has neither the sound or colour of the Amiga and also stressed that neither the Mac or the Atari have MS DOS Capability.

Purely for Business

Commodore's third section of interest in the computer market at the moment is inevitably the business end due to the Amiga's PC AT, XT and MS DOS compatability. Commodore has also launched the PC10 and 20. The PC10 was only recently launched in the US so it's still early days for these machines.

Waxing Philosophical

Nigel Shepherd explained the Commodore philosophy in the following terms. "Commodore will continue to design and manufacture machines that are competitive and will enable both Commodore and retailers to make money. We will continue to be in the MS DOS market place. There will always be a home market and Commodore's original forte is serving that market. Commodore is moving up market to desk top publishing and corporate type machines. We are committed to today's and to future market places."

He added: "The difference between today and two years ago is that now a machine can be suitable for all of the markets – home, personal and business – all in one box whereas before there were three distinct machines. Commodore has one major advantage – the Amiga chip set."

Asked specifically about Commodore's UK outfit, Nigel replied: "Commodore North America has been through tough times in the last 18 months and like Commodore UK, had to rationalise the business and start all over again." However, Nigel believes that the corner has now been turned. He sees Commodore UK consolidating and building in this country. Absence of major promotion was evident in the past but the company has fought for survival and we will now see a much more aggressive approach. Nigel Shepherd is confident that Commodore will return to being a major factor in the UK marketplace.

Your Commodore certainly hopes so and we'd like to thank Nigel Shepherd for taking time to express his view of Commodore North America.

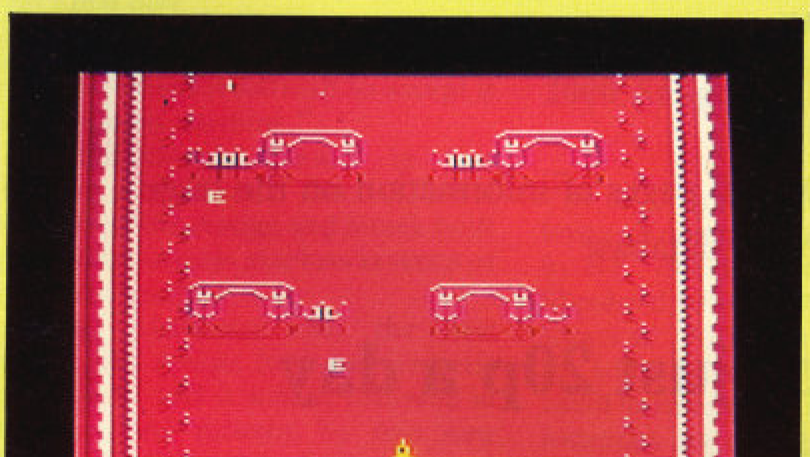
Sport on Channel 64

Futuristic sports games are all the rage at the moment. Try your hand at these out-of-this-world titles.

By Tony Hetherington

Sport in the future (according to the software houses) is to be fast, furious and will usually involve a steel ball. There obviously won't be any grass left in the world as not a blade is in sight as an average of 1.8 humans battle or race droids, robots and gravcraft in purpose built stadia, planets and tracks.

Futuristic sports games are inevitably influenced by science fiction films, notably *Rollerball* and *Death Race 2000*, and are often developed from existing sports to bolster flaging telecast ratings.

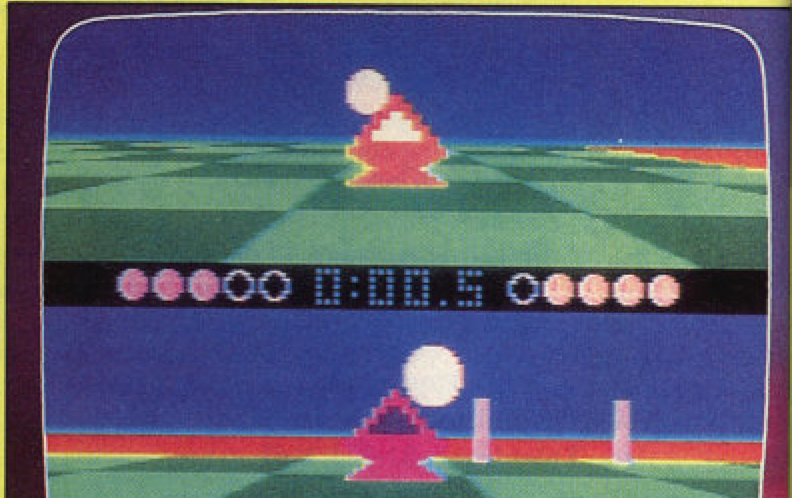




Racing Destruction

Hewson's *Alleykat* leads off the future racers as you compete in a bizzare set of challenges known as the Alleykat races. Written by Uridium author, Andrew Braybrook, the racer must compete in contests such as the Moot Open, Astro Classic, Galaxad Open and Mad-Max Smash. He pilots a custom built convertable racer that can swap from high speed, slimline single racer mode to a slower twin laser craft for maximum destructive power. The races are run over a variety of planet surfaces that range from the fragile shatterock and the leafy Arboris to the indestructable hardwall which will destroy a racer on impact.

The object of the game is to amass points by winning races and prize money so that you can enter more racers to gain more points. Points are won by completing the race (an achievement in itself), by shooting the laser firing robot gravcraft that are thrown in to liven things up and by



acquiring bonus points that depend on the race type. In time trials bonus points are linked to your time, in endurance racers it's surviving that matters and in destruction racers you must destroy the landscape.

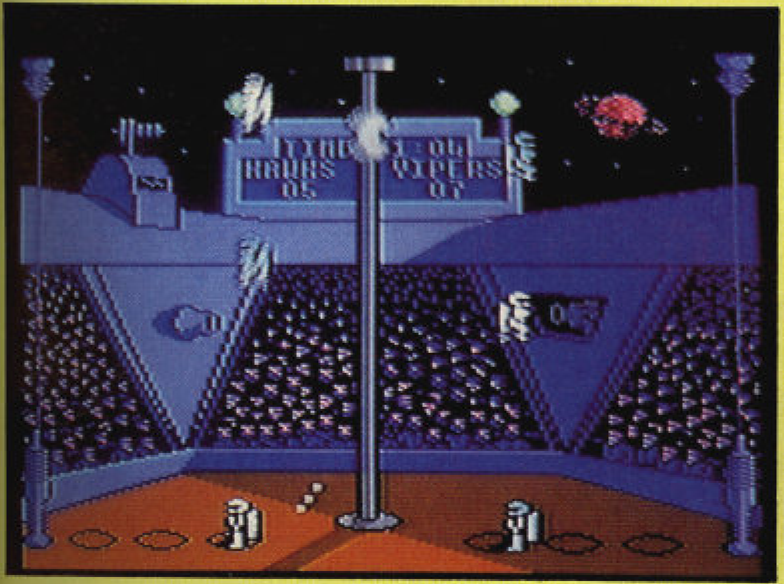
On the Ball

Gremlin's *Trailblazer* is, by comparison, a far simpler game in which you must bounce a ball down a track that hurtles out of the screen at you at breakneck speed. Again staying on the track is a major task in itself without your opponents efforts to push you off into oblivion. Bouncing from square to square you must plan your route along the careering platform avoiding the traps that slow you down, reverse your controls or send you plummeting out of the contest. Then you're ready to gently push your opponent over the edge to gain those crucial seconds to win the race.

Ballblazer (Activision) sets two Rotofoils in competition with each other as they race around a bevelled pitch chasing a steel ball. Their aim is to fire the ball into one of two moving goals.

In a timed game the foils that are controlled by either human or droid pilots can catch or fire the ball using their protective forcefields. The outcome is decided on points with a goal being worth more if it is scored from a distance. A fast and furious game that's incredibly addictive to play.

The same could also be said of Odin's *Hypa-Ball* which features the battle for the Super Cup between two three man teams, the Hawks and the Vipers. Before the match you can choose your players from the 10 man squad to be your jetpowered strike one and two and Earthbound grounder. After a quick appearance by the cheerleaders the players take their positions either side of the central pole on which the goal globe travels on its relentless path up and down making goals even harder to get.



Thanks to a force field network the players are trapped in zones in between which the ball bounces and rebounds until captured by a player. However he has only two seconds (otherwise he concedes a penalty) to pass the ball or shoot at goal.

After 10 gruelling minutes of play the result is reported in the popular newspaper the Echo.

Bouncing Out

Room 10 is an unlikely spin off from CRL's *Tau Ceti* and is found in the Gal-corps leisure complex. Described as a mixture of Ballblazer and Pong the game features a split screen battle two giant bats to knock a ball behind their opponent to score points.

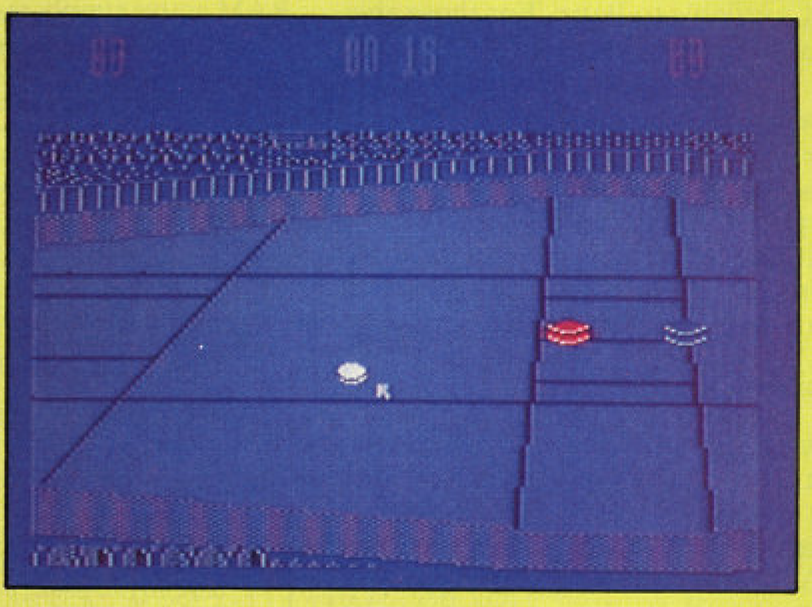
Knocking a ball into a goal is the aim of Argus Press Software's *Xeno* and is a futuristic development of shove halfpenny football. The two contestants must fire their xeno craft to intercept and knock the ball into the goal to score in front of a capacity crowd.

Finally, the bizarre *Bounces* from Beyond defies description as two armour clad knights, called Eric and Ashley fire a steel ball at each other and into holes in the roof to score match winning points.

Touchline

Hewson: *56B Milton Trading Estate, Milton, Abingdon, Oxon OX14 4RX.* ***Tel:*** *0235 832939.*

Activision: *23 Pond Lane, Hampstead, London NW3 2PN.* ***Tel:*** *01 431 1101.* YC

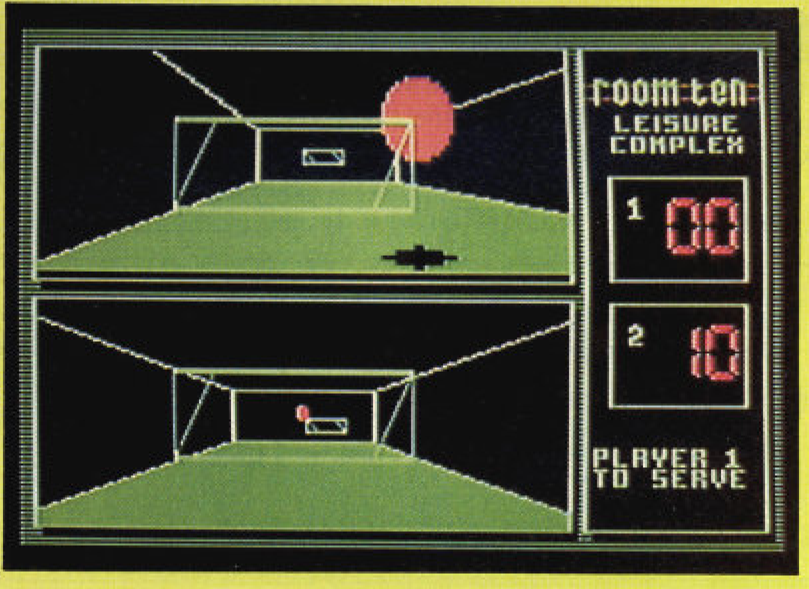


Gremlin: *Alpha House, 10 Carver Street, Sheffield S1 4FS.* ***Tel:*** *0742 753423.*

Odin and Beyond: *First Floor, 74 New Oxford Street, London WC14 1PS.* ***Tel:*** *01 240 8838.*

CRL: *9 Kings Yard, Carpenters Road, London E15 2HD.* ***Tel:*** *01 533 2918.*

Argus Press Software: *Victory House, Leicester Place, London WC2H 7NB.* ***Tel:*** *01 439 0666.*



Basic Memory

Programming in Basic can be a headache especially if you start running out of space. These routines should ease the situation.

By Allen Webb

The 64 has a full compliment of 64K of RAM, but the designers, in their infinite wisdom, made only about 38K available to Basic. For those able to use machine code, the RAM behind the ROMs is easily used but to most others, it's forbidden fruit. There is nice lump of 4K between the ROMs, however, which can be used. Basic keeps track of storage of variables in a collection of zero page pointers. These pointers, along with their starting values, are listed in Table 1.

Pointer Variations

The values of these pointers are changed as program lines or variables are added or removed. By setting these pointers to the RAM between the ROMs, we can have a second variable area. Listing 1 gives a short routine which will do this task for you. The routine lives in the cassette buffer so that it doesn't pinch any memory. The routine has three entry points:

SYS 830: This sets up the table which saves the pointer values to some default values pointing to the spare RAM. This table is switched in when you want to use the extra RAM and is updated when you return to the normal RAM. This command effectively performs CLR on the extra RAM. Since using this command when the extra RAM is active messes things up, it detects which RAM is in use and acts accordingly. Calling it when normal RAM is active gives the required result. Using it with the extra RAM active simply results in a flashing border as a warning and nothing else. As far as I can see, CLR will act correctly on the extra variables when they are active.

```
PROGRAM: LISTING 1

70  2000 FORL=0TO9:CX=0:FORD=0TO
    15:READA:CX=CX+A:POKE830+L*1
    6+D,A:NEXTD
82  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
5A  2040 DATA76,71,3,76,146,3,76
    ,184,3,173,208,2,240,26,162,
    0,1449
20  2050 DATA173,32,208,141,209,
    2,160,0,140,32,208,200,208,2
    50,232,208,2403
6E  2060 DATA245,173,209,2,141,3
    2,208,96,160,0,185,122,3,153
    ,168,2,1899
CE  2070 DATA185,134,3,153,188,2
    ,200,192,13,208,239,96,3,192
    ,3,192,2003
D4  2080 DATA3,192,0,208,0,0,0,2
    08,3,8,3,8,3,8,0,160,804
C7  2090 DATA0,0,0,160,173,208,2
    ,240,3,76,76,3,160,0,185,45,
    1331
00  2100 DATA0,153,188,2,185,168
    ,2,153,45,0,200,192,13,208,2
    39,169,1917
38  2110 DATA255,141,208,2,169,2
    ,141,32,208,96,173,208,2,208
    ,3,76,1924
59  2120 DATA76,3,160,0,185,45,0
    ,153,168,2,185,188,2,153,45,
    0,1365
6F  2130 DATA200,192,13,208,239,
    169,0,141,208,2,169,14,141,3
    2,208,96,2032
```

SYS 833: This switches in the extra RAM. The border turns red to warn you about it.

SYS 836: This switches back to normal RAM. The border is set the light blue to show it.

Attempting to activate a variable set when that set is current may corrupt the pointer tables. Consequently, the routines won't let you take such action.

Once you have the extra RAM switched in, the operating system updates the pointers as required. So that the extra variables are protected, the pointer values are remembered each time you switch to normal variables.

Listing 2 gives a simple demo to show how the routine works. Line 10 performs CLR on the extra RAM and switches in in. Since FRE uses the variable pointers, you will see that it works correctly on both sets of RAM. The routine shows you that two variables sets of variables with the same names can be used.

One word of warning. You must not perform actions which change the pointers or use software which depend on them when the extra RAM is in use – always switch the normal RAM back in first. Such operations include adding or deleting program lines and using assemblers which use the variable pointers to assist storage.

Alternative Process

An alternative method of adding to your available memory is the use of random access on disk to provide virtual memory. Some serious

Table 1

Pointer locations	Function	Starting value
45,46	Start of variables	2051
47,48	Start of arrays	2051
49,50	End or arrays	2051
51,52	Bottom of strings	40960
55,56	Top of variables	40960

programs use this approach to provide HELP information without reducing the memory available to the main program. The Listing 3 provides a general routine which will store and recall blocks of up to 255 bytes on disk. To those of you who aren't in the know, the disk is split into 35 tracks, each comprising of a number of sectors. The number of sectors varies from 17 to 21 depending on the position of the track. Each sector holds on block or 255 bytes.

The program uses a menu system to provide five options. The first option reserves the specified sectors and fills each with a zero byte (@). This is because a zero byte is used as a sentinel to indicate the end of a string. This reservation (or allocation) operation is nullified if you use the validate instruction, so beware!

Option 2 saves a string at the required location. Since you may want to input string of up to 255 bytes, a special input routine (lines 750 to 1030) is used. All you do is type in the string using cursor keys and DEL to edit it. The string must end with an asterisk. When the string is complete, press back arrow to process it. The sectors on the disk are numbered sequentially so that track one holds sectors zero to 20, track two holds sectors 21 to 41 etc. Since tracks are of variable length, the routine from lines 1420 to 1470 is needed to calculate the relevant track/sector from the number of the data block.

Option 3 loads and prints a specified data block. If you want to extract data in your own programs, you should reproduce lines 580 to 680, lines 1420 to 1470. If you're a careful programmer, you should also use the error checking routine (lines 1070 to 1100).

Option 4 prints a map of the disk contents. Allocated but unused sectors are shown as "@". Those containing data blocks are shown as "*". The final option simply allows you to format a disk.

Data saved using this program does not appear on the directory since it is written direct to the disk. If, in fact, you use the track which holds the start of the directory (track 18), and try to load the directory, you will get an interesting result! YC

PROGRAM: LISTING 2

```
2F  10 SY$830
3A  20 PRINT"[CLR]CLEAR AND ACTI
    VATE PROTECTED VARIABLES"
EE  30 SYS833:CLR:PRINT"WE NOW H
    AVE"FRE(1)" BYTES FREE"
70  40 PRINT"[DOWN]NOW SET UP TW
    O VARIABLES:"
5A  50 A$="PROTECTED STRING":Z=1
    .234567
FC  60 PRINT"[DOWN]A$="A$"  Z="Z

63  70 SYS 836:CLR
CC  80 PRINT"[DOWN4]CLEAR AND AC
    TIVATE NORMAL VARIABLES"
09  90 PRINT"WE NOW HAVE"65536+F
    RE(1)" BYTES FREE"
BC  100 PRINT"[DOWN]NOW SET UP T
    WO VARIABLES:"
E1  110 A$="NORMAL STRING":Z=9.8
    76543
C8  120 PRINT"[DOWN]A$="A$"  Z="
    Z
A1  130 PRINT"[DOWN]PRESS A KEY
    TO SEE BOTH SETS"
B6  140 GETI$:IFI$=""THEN140
0E  150 SYS833:PRINTA$,Z
70  160 SYS836:PRINTA$,Z:PRINT
9C  180 FOR D=1TO200:NEXT
5A  190 LO=LO+1:IFLO<10THEN150
43  200 GOTO20
```

PROGRAM: LISTING 3

```
3A  1 REM************************
    *******
2F  2 REM* RANDOM ACCESS TEXT HA
    NDLER *
6F  3 REM*        A + M  1986
        *
37  4 REM************************
    *******
C0  10 PRINTCHR$(14)
89  20 DEF FNA(T)=ABS((T<18)*20+
    (T>17ANDT<25)*18+(T>24ANDT<3
    1)*17+(T>30)*16)
76  30 B$="[S*40]"
64  40 A$="ENTER TEXT TO BE SAVE
    D. TERMINATE THE[SPC3]TEXT W
    ITH *"
77  50 A$=A$+" THEN PRESS [LARRO
    W] TO PROCESS"
DB  60 CU$="[DOWN26]":CR$="[RIGH
    T10]"
0B  70 POKE53281,12:POKE53280,12
    :PRINTCHR$(144)CHR$(147)
0C  80 Y=5:X=6:GOSUB1140:PRINT"[
    SR]ANDOM [SA]CCESS [ST]EXT [
    SU]TILITY"
7E  90 X=8:Y=Y+2:GOSUB1140:PRINT
    "************************"
9D  100 Y=Y+1:GOSUB1140:PRINT"*
    1. ALLOCATE BLOCKS *"
5A  110 Y=Y+1:GOSUB1140:PRINT"*
    2. SAVE BLOCKS[SPC5]*"
02  120 Y=Y+1:GOSUB1140:PRINT"*
    3. READ BLOCKS[SPC5]*"
0F  130 Y=Y+1:GOSUB1140:PRINT"*
    4. SCAN DISK[SPC7]*"
74  140 Y=Y+1:GOSUB1140:PRINT"*
    5. FORMAT DISK[SPC5]*"
87  150 Y=Y+1:GOSUB1140:PRINT"**
    **********************"
E7  160 PRINTCHR$(5):Y=Y+2:X=13:
    GOSUB1140:PRINT"SELECT OPTIO
    N":PRINTCHR$(144)
82  170 GETI$:IFI$<"1"ORI$>"5"TH
    EN170
D5  180 ONVAL(I$)GOTO220,440,580
    ,1180,1510
31  190 REM
CE  200 REM *** ALLOCATE AND ZER
    O SECTORS ***
5D  210 REM
E7  220 INPUT"[CLR]START TRACK";
    T1
0D  230 IFT1<1THEN220
70  240 INPUT "FINISH TRACK";T2
E7  250 IFT1>T2 OR T2>35 THEN 24
    0
44  260 OPEN15,8,15
33  270 OPEN2,8,2,"#"
71  280 :  FOR T=T1 TO T2
B8  290 :      FORS=0 TO FNA(T)
62  300 :      PRINT#15,"B-A"0;T;
    S
1A  310 :      PRINT#15,"B-P"2;1
1D  320 :      PRINT#2,"@"
69  330 :      PRINT#15,"B-W"2;0,
    T,S
8A  340 :      GOSUB1070
D8  350 :      Y=22:GOSUB1140:PRI
    NT"[SPC19]"
38  360 :      Y=22:GOSUB1140:PRI
    NT"TRACK"T" SECTOR"S
58  370 :      NEXT S
3D  380 :  NEXT T
2E  390 FORD=1TO1000:NEXT D
05  400 CLOSE15:CLOSE2:GOTO70
14  410 REM
77  420 REM *** INPUT AND SAVE T
    EXT ***
20  430 REM
8E  440 GOSUB750
6E  450 OPEN15,8,15
F9  460 OPEN2,8,2,"#"
C1  470 GOSUB1420
CE  480 PRINT#15,"B-P"2;1
56  490 X=0:Y=22:GOSUB1140:PRINT
    "[SPC19]"
E6  500 X=0:Y=15:GOSUB1140:PRINT
    "WRITING MESSAGE"MN:PRINT "T
    O TRACK"T" SECTOR"S
DA  510 PRINT#2,I$
3C  520 PRINT#15,"B-W"2;0,T,S
01  530 GOSUB1070
1F  540 CLOSE2:CLOSE15:FORD=1TO1
    000:NEXT D:GOTO70
A7  550 REM
14  560 REM *** READ TEXT ***
B3  570 REM
A4  580 PRINTCHR$(147):OPEN15,8,
    15
55  590 OPEN2,8,2,"#":P=1
A3  600 INPUT"MESSAGE NO";MN
50  610 GOSUB1420
EC  620 PRINT"[DOWN]TRACK.."T,"S
    ECTOR.."S
16  630 PRINT#15,"B-P"2;P
45  640 PRINT#15,"B-R"2;0,T,S
66  650 GET#2,O$:IFO$="@"THEN680

C5  660 PRINTO$;:P=P+1:PRINT#15,
    "B-P"2,P
9A  670 GOTO650
CC  680 CLOSE2:CLOSE15
43  690 X=8:Y=22:GOSUB 1140:PRIN
    T"[RVSON]PRESS ANY KEY TO CO
    NTIUE"
26  700 GETI$:IFI$=""THEN700
48  710 GOTO70
5D  720 REM
9D  730 REM *** INPUT A STRING O
    F TEXT OF UP TO 255 CHARS **
    *
69  740 REM
A1  750 PRINTCHR$(147);:CH=0:DE=
    30:SA=1024+120
41  760 PRINTA$:PRINTB$
1D  770 PRINT"[HOME,DOWN3]";
63  780 GETI$:IFI$<>""THEN810
69  790 A=PEEK(SA+CH):POKESA+CH,
```

```
    A+128:FORD=1TODE:NEXT
23  800 POKESA+CH,A: FORD=1 TO D
    E:NEXT D:GOTO780
9A  810 IFI$="[LARROW]"THEN900
6F  820 IFI$=CHR$(13)THEN780
CD  830 IF (I$=CHR$(157)ORI$=CHR
    $(20))ANDCH>0THENCH=CH-1:PRI
    NTI$;:GOTO780
FA  840 IF (I$=CHR$(157)ORI$=CHR
    $(20))ANDCH=0THEN780
24  850 IFI$="[UP]"ANDCH>40THENC
    H=CH-40:PRINTI$;:GOTO780
27  860 IFI$="[DOWN]"ANDCH<215TH
    ENCH=CH+40:PRINTI$;:GOTO780
17  870 IFI$="[HOME]"THENCH=0:PR
    INTI$;:GOTO780
83  880 IFCH<255THENCH=CH+1:PRIN
    TI$;:GOTO780
B9  890 POKE 53280,2:I$="":POKE5
    3280,12:  GOTO780
C7  900 I$="":CH=SA
28  910 C=PEEK(CH):IFC=42THEN960
76  920 IF(C>31ANDC<64)THENCV=C:
    GOTO950
CE  930 IF C<26 THEN CV=C+64:GOT
    O950
48  940 IF C>64 ANDC<91THENCV=C+
    128:GOTO950
18  950 I$=I$+CHR$(CV):CH=CH+1:G
    OTO910
CF  960 PRINT:X=0:Y=12:GOSUB1140
    :PRINT"[WHITE,SY]OUR TEXT IS
    :":PRINTI$
A0  970 PRINT"[BLACK,DOWN,SO]K T
    O PROCESS? Y/N"
C7  980 GETZ$:IFZ$=""THEN980
2A  990 IFZ$<>"Y"THEN750
83  1000 I$=I$+"@"
5A  1010 INPUT"[DOWN2]MESSAGE NU
    MBER";MN
10  1020 PRINTCHR$(147)
84  1030 RETURN
9B  1040 REM
04  1050 REM *** CHECK ERROR CHA
    NNEL ***
A7  1060 REM
B4  1070 INPUT#15,EN,EM$,ET,ES
4A  1080 Y=23:X=0:GOSUB1140:PRIN
    T"[SPC18]"
B4  1090 Y=23:X=0:GOSUB1140:PRIN
    TEN;EM$,ET;ES
DE  1100 RETURN
D5  1110 REM
36  1120 REM *** POSITION CURSOR
     ***
E1  1130 REM
F5  1140 PRINT"[HOME]"LEFT$(CU$,
    Y)TAB(X);:RETURN
0D  1150 REM
43  1160 REM *** SCAN AND DISPLA
    Y BAM ***
19  1170 REM
E3  1180 INPUT"[CLR]START TRACK"
    ;T1
E5  1190 IFT1<1THEN1180
54  1200 INPUT "FINISH TRACK";T2
9C  1210 IFT1>T2 OR T2>35 THEN 1
    200
90  1220 PRINT"[HOME,SPC13,SS,SE
    ,SC,ST,SO,SR]"
AD  1230 PRINT"[SPC5]0[SPC9]1[SP
    C9]2 [ST,SR,SA,SC,SK]"
F7  1240 PRINT"[SPC5]01234567890
    1234567890
DB  1250 OPEN15,8,15:OPEN2,8,2,"
91  1260 :   FORT=T1 TO T2:PRINTT
    AB(3)"   ";
DB  1270 :        FORS=0 TO FNA(T)
32  1280 :          PRINT#15,"B-P"2;
    1
C4  1290 :          PRINT#15,"B-R"2;
    0,T,S
30  1300 :          GET#2,O$:IFO$<>"
    @"THENO$="*"
1A  1310 :          PRINTO$;
0C  1320 :        NEXT S
C0  1330 :   PRINT LEFT$(CR$,21-F
    NA(T));T
71  1340 :   NEXT T
2B  1350 CLOSE2:CLOSE15
32  1360 X=8:Y=22:GOSUB 1140:PRI
    NT"[RVSON]PRESS ANY KEY TO C
    ONTIUE"
1B  1370 GETI$:IFI$=""THEN1370
27  1380 GOTO70
FC  1390 REM
56  1400 REM *** CONVERT MESSAGE
     NUMBER TO TRACK AND SECTOR
08  1410 REM
87  1420 IF MN<=357 THEN T=INT(M
    N/21)+1:S=MN-(T-1)*21:RETURN
AD  1430 IF MN>357 AND MN<=490 T
    HEN TR=18: TL=20: NS=357: GO
    TO 1460
DE  1440 IF MN>490 AND MN<=605 T
    HEN TR=25: TL=18: NS=490: GO
    TO 1460
61  1450 TR=31: TL=17: NS=605
B5  1460 RE=MN-NS
04  1470 T=INT(RE/TL): S=RE-TL*T
    : T=T+TR:RETURN
42  1480 REM
5C  1490 REM *** FORMAT DISK ***
6E  1500 REM
84  1510 PRINTCHR$(147)
3A  1520 INPUT "DISK NAME";NA$
05  1530 INPUT "ID";ID$
C1  1540 FI$="NO:"+NA$+","+ID$
B3  1550 INPUT"[DOWN2,SA,SR,SE]
    [SY,SO,SU] [SS,SU,SR,SE]";I$
7E  1560 IF I$="Y"THENOPEN15,8,1
    5,FI$:CLOSE15
E8  1570 GOTO70
```

Games Reviews

There are some fast and furious games this month and some more leisurely titles for you to dip into.

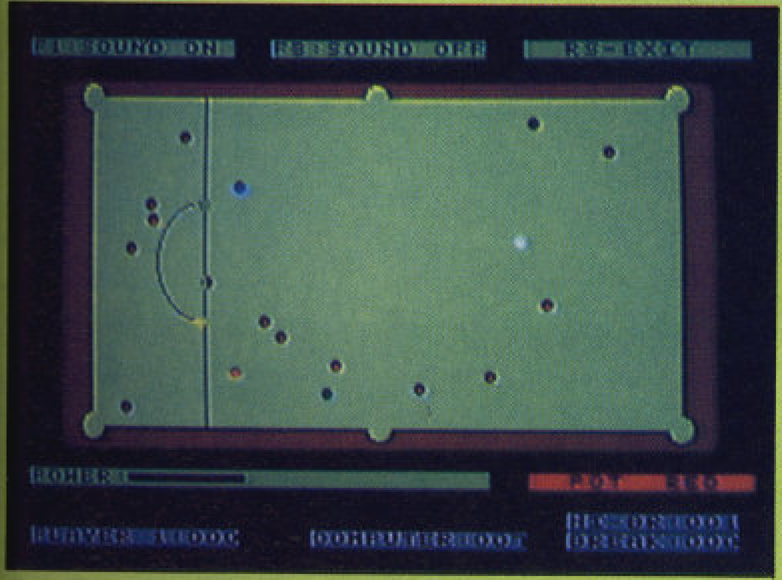
CLASSIC SNOOKER

Here's a chance for budding Jimmy Whites to try and emulate their green baize heroes and all from the comfort of their own home. Classic Snooker has enough options to keep even the most devote fan quiet during the odd hour where, due to some unfortunate error in the programming schedules, there isn't actually any of the real stuff on the box.

There are three skill levels and you can choose to play either against a friend or the computer. Control of the game is simplicity itself. Position the cueball in the 'D' if necessary, select the angle of the shot, decide what, if any, spin you want to impart on the cueball and finally select the power required. If you pot a red, you are prompted for a colour and this is simply a matter of moving the cursor over your choice. Details of the scores, current break and highest break to date are displayed below the table. There is an edit mode included in the program so you don't have to play a full game if you don't want to or you can set up and practice all those fancy trick shots.

The only problem with the game, and unfortunately it's a major one, is that the balls are far too active when hit. You only have to break into the pack at half speed and you are treated to balls whizzing all over the table in the most amazing flaunting of Newton's Laws of Motion. You certainly have more than enough time to chalk your cue between shots.

All this is a pity because it totally ruins the playability of what is otherwise a well presented game. A brave effort but one that has sadly miscued. **G.R.H.**

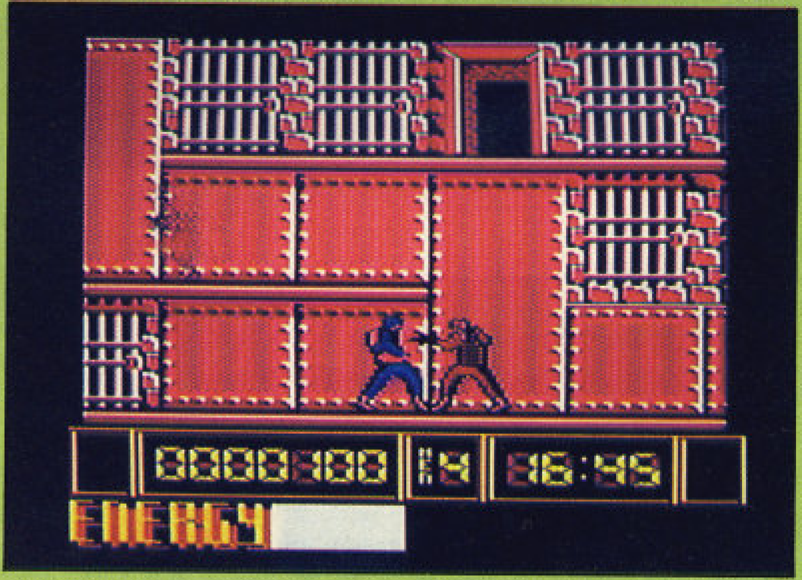


Touchling

Title: *Classic Snooker.* ***Machine:*** *C64.* ***Supplier:*** *Anco, 35 West Hill, Dartford, Kent DA1 2EL.*
Originality: *1/10.* ***Graphics:*** *6/10.* ***Playability:*** *4/10.* ***Value:*** *4/10.*

KNUCKLEBUSTERS

By the year 2030, more than one in three of the adult population was in prison after years of riots and civil disobedience. Overcrowding was overcome by the simple



expedient of using chemistry or the surgeon's knife to remove any offending part of mind or body. This in turn produced thousands of socially useful androids who were used to patrol the less savoury sections of the city and who had instructions to kill on sight any escaping prisoner. Not as you might imagine by the simple method of blowing their brains out, but rather by hand to hand combat which at least afforded the prisoner a fighting chance. But who am I to argue as withot such far fetched plots as these, computer games would be so much the poorer?

As it happens, one such prisoner was trying to escape (I bet that surprised you). You play the part of Deke in this latest beat-em-up from Melbourne House. In order to gain your freedom, you must travel through six zones of the city, hitting or avoiding the androids as you see fit. The zones include the cell block, guard area, prison wall, city, down town and the outer wall. Available actions are run left and right, jump and drop, punch and kick. There are five different types of android to encounter as well as potentially useful items hidden behind doors and oil barrels. Al this must be done against the clock as you managed to sabotage the prison computer causing the entire city to self destruct. As a hint as to how much time you have got, it may be co-incidental that Ron Hubbard's sound track lasts for 17 minutes.

And that's all there is to it. The graphics are so-so, the gameplay dreadful. Save your money. **G.R.H.**

Touchline

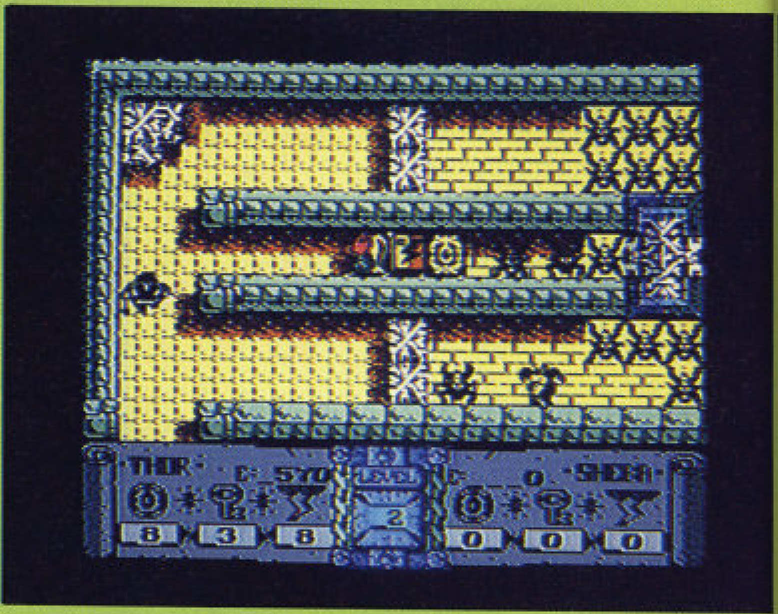
Title: *Knucklebusters.* ***Machine:*** *C64.* ***Supplier:*** *Melbourne House, 60 High Street, Hampton Wick, Kingston-upon-Thames, Surrey KT1 4DB.*
Originality: *3/10.* ***Graphics:*** *6/10.* ***Playability:*** *3/10.* ***Value:*** *3/10.*

DANDY

Try this storyline for size. One or two players working as a team rush like mad through 15 dungeons, knocking the stuffing out of as many nasty, evil monsters as possible and pausing only to pick up treasure, keys and the odd bite to keep your strength up. Sound somewhat familiar? Yes, it's Gaun ... oops Dandy, a Gauntlet clone from Electric Dreams.

The two characters are Thor and Sheba, two not very nice characters, all brawn and no brain. They can withstand a considerable amount of damage before even they succumb to the forces of evil. Unfortunately, the vast hordes of nasties are intent on cutting you to ribbons, a slice at a time. What is worse, these creatures of dark seem to come in an unlimited supply thanks to the fact that there are monster generators scattered liberally around each dungeon. If you can destroy every creature on a particular screen, you can also destroy the generators so that they plague you no longer.

Food is only one of the vital goodies for pick up on your travels, restoring as it does your battle weary body. Keys are just as important as they are required to allow you access to other parts of the dungeon. Beware as they can be destroyed by shooting them and if you are not careful in the thick of battle, you may well find yourself cut off! Spells can be found and these have the random effect of killing, disorientating or



paralysing the enemies. Treasure has no real function apa from being something to make your journey worthwhile. I an emergency, you can trade your treasure for energy. The are teleports to be used and completion of a set of dungeon gives you a clue to solving a riddle.

All the backgrounds are bright and colourful and the are plenty of creatures crawling round the screen at an given point but the overall effect is to make the screen loo very messy. Compare this to Gauntlet where the screens a a lot simpler but look a lot better for it. Not a bad game, bu missing that certain spark that makes it a great one. **G.R.H**

Touchline

Title: *Dandy.* ***Machine:*** *C64.* ***Supplier:*** *Electric Dreams, 3 Carlton, Crescent, Southampton SO1 2EW.*
Originality: *6/10.* ***Graphics:*** *6/10.* ***Playability:*** *7/10.* ***Valu*** *7/10.*

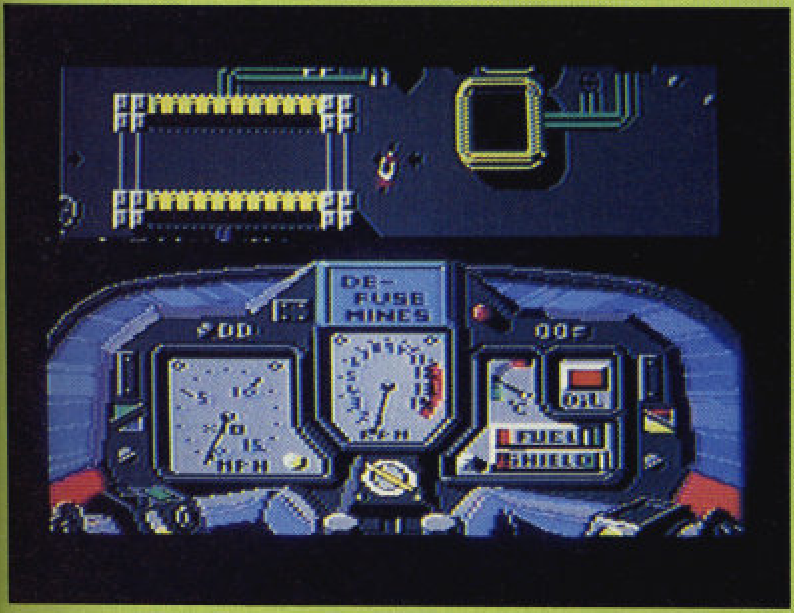
RED MAX

All you have to do to complete the game and save th Astroworld is to deactivate 27 fission mines on the surfac find the lift and turn on eight backup nuke-core coolin systems in the engineering area, shut down four power plan and finally re-animate nine crew members in the hibernatio complex! This shouldn't be a problem as you're riding Re Max!

The Astroworld is one of a group of anti-gravity orb sent out to escape the Sun as it began an unexpected Sup Nova cycle. Safely past the Sun the mission went badl wrong when members of the Renegade Death Lords lande and sabotaged the power plants. The alarms sounded an now you must ride Red Max to the rescue.

The game plays like a sequel to Mastertronic's The La V8 as you drive your bike around the planet's surface in th top half of the screen while monitoring controls in th bottom half.

The planet surface is packed with traps to hinder an destroy your efforts. These include lase fences and gree biological slime as well as the buildings that destroy you o

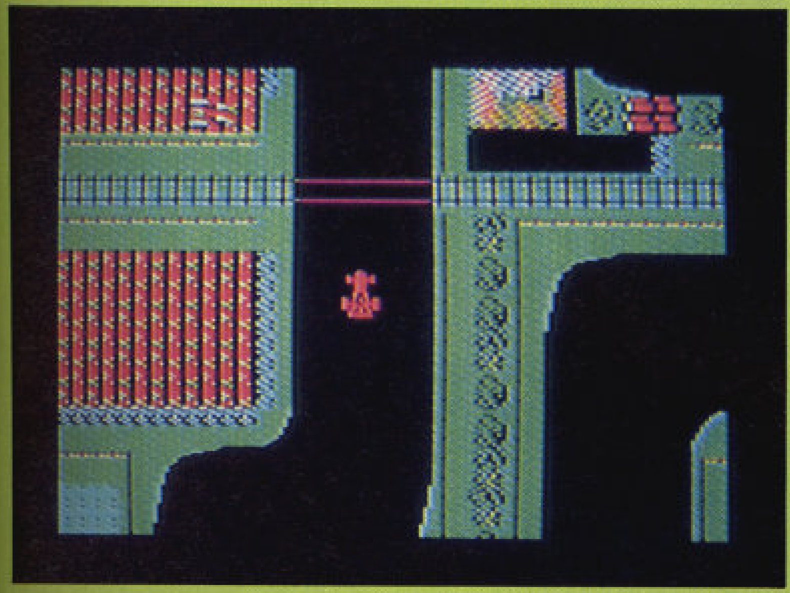


contact. My favourite screens are in the underground caverns in which you must drive through lakes and rivers that try to drag you along with the current.

Red Max is yet another highly addictive budget game that drives you back for another game, again and again.
T.H.

Touchline

Title: Red Max. ***Supplier:*** *Code Masters, 1 Beaumont Business Centre, Beaumont Close, Banbury, Oxon OX16 7RT.* ***Machine:*** *C64.* ***Price:*** *£1.99.*
Originality: *6/10.* ***Graphics:*** *7/10.* ***Playability:*** *7/10.* ***Value:*** *9/10.*



STREET MACHINE

Yet another racing simulation game. You control a high-powered turbo charged ultimate automobile although you would not think it to look at the screen which depicts an overhead view of you and the other seven cars as you drive round a scrolling track. The cars look like souped down Dinkys.

Your race is split into three sections – normal conditions, nightime and icy. Control is straightforward. Accelerate, decelerate, left, right and brake. The usual objective is to get round the course as fast as you can but there is no indication of how well you were doing before you wrote off your vehicle. Even a simple 'You have travelled x miles' on a high score table would help considerably.

Major crashes result in your car exploding and game over time. Minor bumps and general wear and tear can be fixed although it costs you time. A two page menu is presented showing all the various bits of your car and the amount of damage that they have accrued. Anything that is more than 80% damaged must be fixed. This involves moving the cursor to the right a bit and waiting. Damage is repaired with time and you are limited as to how much time you have available. This part of the game is dull in the extreme – it is just a case of looking down the list for high numbers. The name of the part is irrelevant.

This game is neither original nor addictive. It would have been reasonable if it had come out in 1983 but now, it looks very dated. In the computer game Grand Prix, Street Machine barely makes it over the starting line. **G.R.H.**

Touchline:

Titles: *Street Machine.* ***Supplier:*** *Software Invasion.* ***Price:*** *£7.95.* ***Originality:*** *2/10.* ***Graphics:*** *5/10.* ***Playability:*** *5/10.* ***Value:*** *3/10.*



BLOOD 'N GUTS

Decathlon barbarian style is the subject of the latest game from Swedish software house American Action. The game that promises all of the violence and brutality you've ever dreamed about features 10 ancient contests in which the loser literally loses his head (thanks to a handy on podium guillotine!)

You can select your athlete from the motley collection of Knorr, Hawk, Nop and Dog who does battle against either a human or computer opponent in challenges where the ancient art of joystick waggling is crucial to victory.

The contestants are tested to the full by events that examine their strength, accuracy and constitution in front of a critically violent crowd.

During the contest they compete in a tug of war where the loser ends up in a river, the tower jump where a successful leaper must land on his head and the polefight over a ravine

when the loser takes a dive!

A barbarian in stocks froms the live target for the human hit event in which the player must hurl rocks at his nose, arms and legs. In the axe throwing the barbarians get a chance to throw axes at each other and in the cat throwing a poor moggy hurtles through the air and lands dangerously close to a hungry looking crowd.

My favourite event is the beer drinking in which our heroes must quaff three barrels of beer without spilling a single drop. A mixture of timing and waggling are required to drain the barrel and deliver the victory belch before your opponents cleared the froth. Finally, three rounds of arm wrestling end the contest with a seagull delivering the final blow to the loser.

Each event is supported with "fun" graphics such as a cross section of a barbarians head so that you can control the flow in the beer drinking and inserts of the players during the mountain walk to counteract any loss of balance.

Overall the game is good fun to play despite it's raw appearance and makes a welcome change from the slopes, fields and tracks of the more serious sports simulations.

T.H.

Touchline

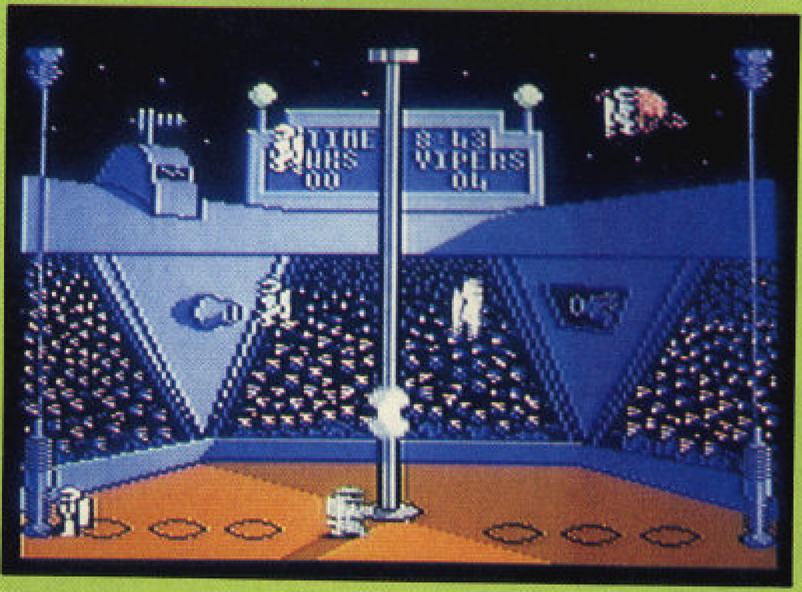
Title: *Blood 'n Guts.* ***Supplier:*** *American Action, Box 10090, 200 43 Malmo, Sweden.* ***Machine:*** *C64.*
Originality: *8/10.* ***Graphics:*** *6/10.* ***Playability:*** *9/10.* ***Value:*** *8/10.*

HYPA-BALL

It's the day of the Odin Super Cup and a titanic clash between the Hawks and Vipers. You captain the Hawks in the ultimate team game in the Universe – Hypa-Ball.

Before the match can begin you must choose your team from the pool of 10 players knowing that the computerised vipers are just as eager to snap up the stars. You can judge a players abilities from his strength, speed and agility ratings as you scroll along the likes of Alex Grunt, Fredo Flange and Stu Gobwinge.

After a few disastrous games when you're slaughtered in the 10 minute matches, you'll begin to see which are the best players as the computer will pick these ones. However as you get first pick you should soon be in with a chance.



The Hypa-Ball stadium is split into two halves by a central pole along which the goal ball relentlessly moves up and down at a constant rate. At either edge of the screen the pitch is bounded by a force field that teleports the steel playing ball into the other half.

After a quick twirl from the cheerleaders the players take their position. The strike ones and twos hover on either side of the pole and are restricted to that half of the field, whereas the grounder can move where he wants to as long as he keeps his feet on the ground. The match begins as the ball is fired into play.

Joystick controls move one strike and the grounder at any one time. This takes a while to get used to but soon you'll be chasing ball. Once you catch it you have to think quickly as you've only got 2.5 seconds to get rid of it otherwise you'll concede a penalty and a certain goal.

Goals are scored by firing the ball at the goal but since it's a moving target this isn't easy. In a 10 minute match against a good computer opponent your concentration must be total as the slightest lapse will let him in to score.

A fast and furious, futuristic sports game supported by super sounds and speedy gameplay.

T.H.

Touchline

Title: *Hypa-Ball.* ***Supplier:*** *Odin, 74 New Oxford Street, London WC1A 1PS.* ***Machine:*** *C64.*
Originality: *8/10.* ***Graphics:*** *8/10.* ***Playability:*** *9/10.* ***Value:*** *8/10.*

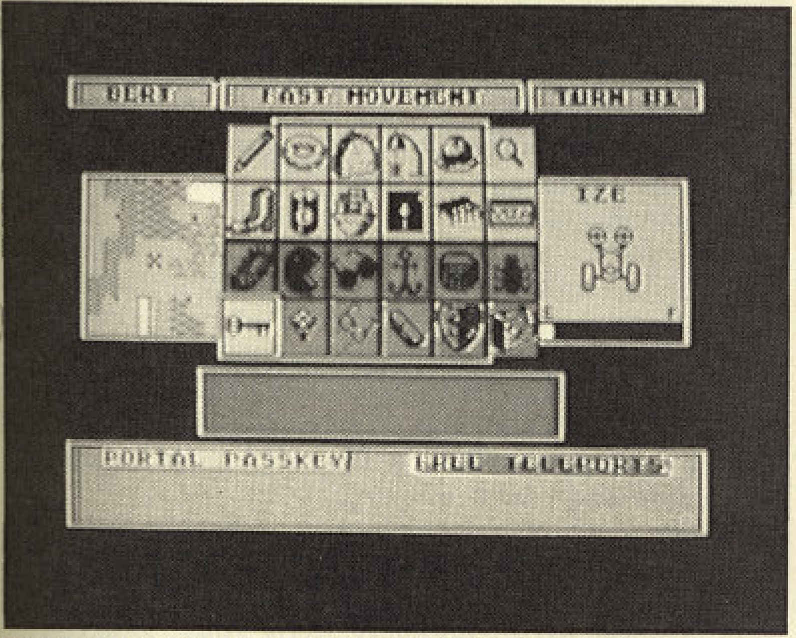
ROBOT RASCALS

Robot Rascals is the latest game to be released by Electronic Arts (through Ariolasoft) and is a game that's half computer game and half card game!

Basically, the game is a multi-player treasure hunt with a hand of cards deciding what the players are looking for. Four cards are dealt as the program is loaded in. Then the players select one of the 10 robots that would each be at home in Electronic Art's classic game M.U.L.E. Although they are visibly different, there doesn't seem to be any difference in their strengths or abilities.

Each turn, each players gets to move his robot around the alien world of Laustenfownd seeking out their selected artefacts. Moving through rocks or trees costs more energy than strolling through the plains. Either way this energy is deducted from the robots turn allocation. When all the energy has gone the turn is over. As well as moving a robot can scan for one of the 24 items that range from a denim disk to a digital donut. The robot then spins around (the quicker the spin the closer you are to the object) and finally points in the direction you need to go in. Collect all four objects and return home (in the centre of Laustanfawnd) and you've won the game.

Unfortunately, it isn't that simple as the other players are out to stop you. There's another pack of cards, the luck cards, that can force you to show your hand to the others, allow you to swap one of your cards for somebody else's or get everyone to swap with the descriptive "pass the trash



card". All this wheeling and dealing is necessary as some cards (and the objects they represent) are better than others such as the Super Shield and Velocity Vitamin that add to your robot's powers whereas the Energy Eater and Action Anchor slow you down. There's even a killer card that stops you from winning unless you can pass it on to someone else. This card gets passed around a lot.

The mischief doesn't end with cards as you can also get your robot to go and mug the other players by ramming them and the stealing what you want but you can also use energy to build shields to protect yourself from muggers.

Finally just as you thought you had things under control the game alters one of its global factors such as slowing down all movement or increasing the energy and scuppers your plans.

A fun game for all the family that is best played with the maximum four players to allow maximum sculduggery. Believe me this can get vicious as people have been known to drop objects that I've wanted at the bottom of lakes just to postpone my victory celebrations but don't worry I'll get revenge.

T.H.

Touchline

Title: Robot Rascals. ***Supplier:*** *Electronics Arts (Ariolasoft), 68 Long Acre, London WC2E 9JH.* ***Machine:*** *C64 disk.* ***Price:*** *£16.95.*
Originality: *8/10.* ***Graphics:*** *7/10.* ***Playability:*** *9/10.* ***Value:*** *7/10.*

LIGHT FORCE

Piloting a lone Lightforce fighter craft, here is yet another scenario giving you the chance to put the wrongs of the Universe to right. This time, the object of your mission is revenge as you attempt to wipe out an alien force that has seized a Terran-settled system on the edge of the galaxy. Yes folks! It's another shoot-em-up.

Why is it that whenever there is any sort of trouble, you are the only person around capable of sorting it out? This time, the 'trouble' comes in the form of a few thousand alien ships and ground defences spread over such divergent landscapes as jungles, asteroid belts and ice-planets.

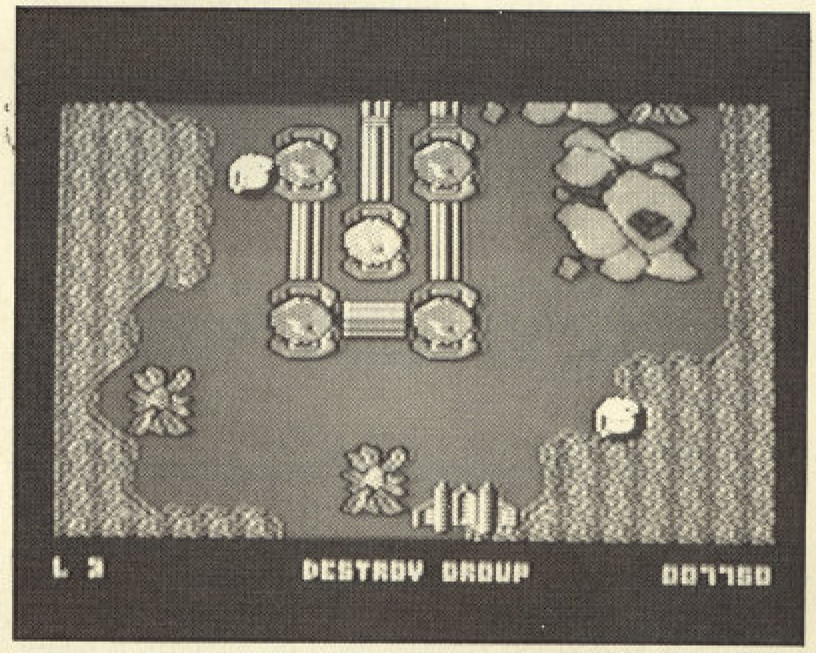
Despite the unoriginal storyline, Lightforce plays very well indeed. The graphics, while not quite as stunning as the Spectrum version, are still noteworthy. The game itself is basically one of learning the patterns of the airborne aliens whilst at the same time, manoeuvring yourself into a position whereby you can blast the ground targets. Your task is made more tricky as these need several hits to destroy them. They are vital though. Take out four control centres and you earn yourself a most welcome extra life. Apart from your twin lasers, there are other special weapons to be found and activated as you continue your aerial Rambo act.

Faster Than Light, the company producing Lightforce has managed the one ingredient that makes shoot-em-ups stand out from the crowd. The game is incredibly addictive. Couple that with the on screen effects and Lightforce becomes an essential purchase for anyone who enjoys a fast blast.

G.R.H.

Touchline:

Title: *Lightforce.* ***Supplier:*** *Faster Than Light, Sedgley Road East, Tipton, West Midlands DY4 7UJ.* ***Machine:*** *C64.* ***Price:*** *£9.95.* ***Originality:*** *7/10.* ***Graphics:*** *8/10.* ***Playability:*** *9/10.* ***Value:*** *9/10.*

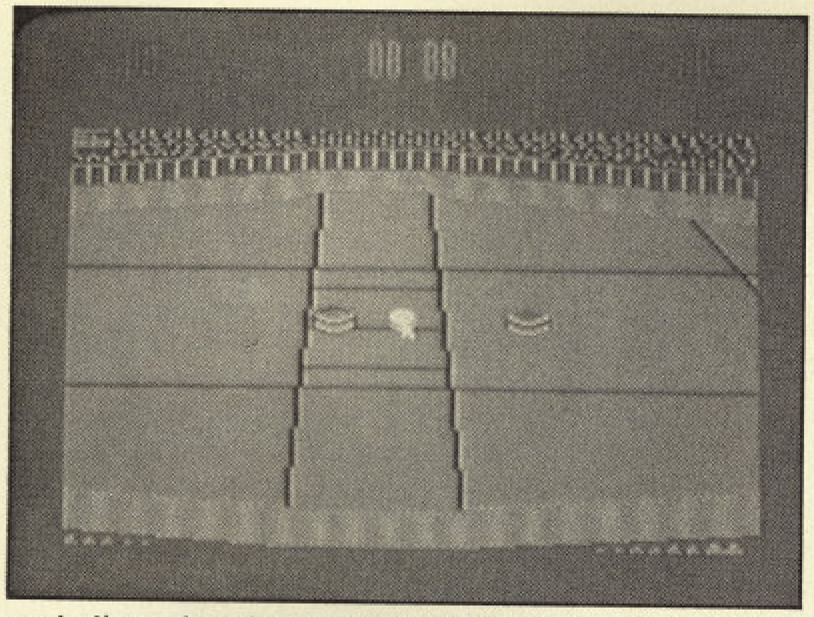


Xeno

Developed from a game played by platinum miners, back in the 23rd century, Xeno was originally a game with few rules and considerable violence. The basic idea was a fairly traditional one – try to hit a puck into your opponent's goal more times than he managed to do the same to you. If the puck or you happened to hit the opponent, tough luck!

In today's sanitised version, the game has become a huge spectator sport, the rules have been tidied up somewhat and champions become legends overnight. Xeno is your chance to become one of the sporting heroes of the galaxy.

The game is a sort of space age ice hockey. Each player controls a disk and takes it in turn to fire it anywhere on the lozenge shaped rink, the ultimate objective being to knock the puck into your opponent's goal. You can try and hit the



puck direct, knock your opponent's disk out of the way or try to block his shot. The game is played over four quarters and the person with the highest score is the winner.

Playing Xeno is simplicity itself – you simply move a small arrow around the pitch, press fire and your disk travels in the appropriae direction. The games can effectively become user defined as there are a number of variables that you can fiddle with: one or two players, the length of each quarter, the amount of time between shots and a handicapping system for the computer. In practice, the default values work as well as any others and lead to a fast and furious game although not one in which you will be beaten out of sight by the computer.

Xeno is a well implemented, simple game that is great fun to play. **G.R.H.**

Touchline:

Title: *Xeno.* ***Supplier:*** *A'n'F, Victory House, Leicester Place, London WC2H 7NB.* ***Tel:*** *01 439 0666.* ***Machine:*** *C64.* ***Price:*** *£8.95.* ***Originality:*** *6/10.* ***Graphics:*** *6/10.* ***Playability:*** *9/10.* ***Value:*** *6/10.*

THE DOUBLE

Every football manager's dream is to achieve the 'double', by winning both the league and FA Cup in one season. This achievement has only been done five times in the history of English football but here you can try and make it six with this new football simulation game from Scanatron.

Being a football nut myself I can honestly say that this is by far the most realistic game of its kind I have come across. All the usual gameplay features are included with this type of game, but this particular one has many better features then its rivals.

Included among the options are ones that allow you to employ scouts to report on any team or player from any division and a physiotherapist to help nurse your injured players. As well as coping with the teams problems you are asked to deal with the running of ground improvements, sackings, wages and even estimating your attendance. Underestimating the crowd can result in terrace battles whilst over estimating can result in huge policing bills and a lecture from your chairman.

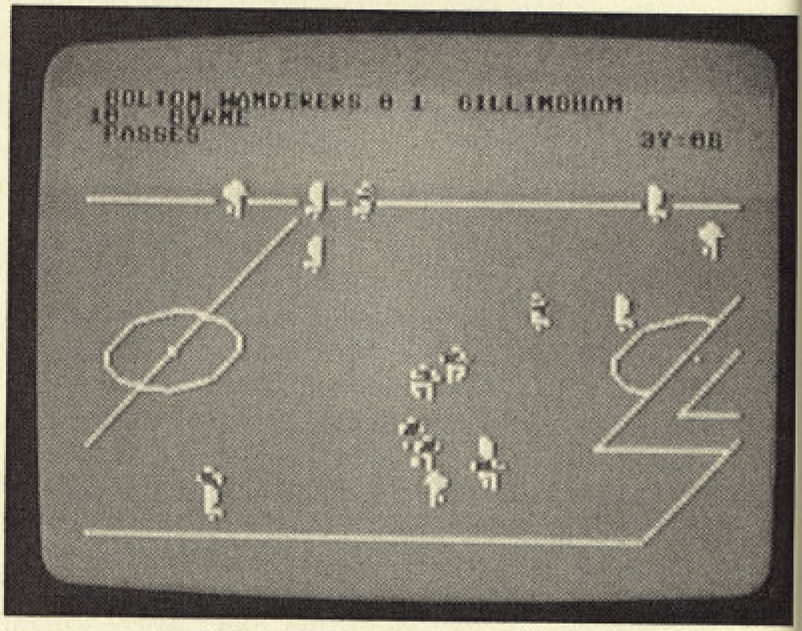
Except for cup matches, watching games is optional and if your side is having a particularly poor spell then you may wish to watch another game from another division. The simulations are rather lengthy and take about 15 minutes in all but commentary of the game helps identify the quality of your players.

After each game you are given the scores, scorers and attendance figures for all matches. The attendance figures and playing squads were selected from the 1985-86 season and add a very up to date dimension to the game.

Overall 'The Double' is an exceptionally realistic game and an absolute must for any football fan but it is at times rather slow and time consuming. **S.K.**

Touchline:

Name: *The Double.* ***Price:*** *£10.95.* ***Machine:*** *C64.* ***Supplier:*** *Johnson Scanatron Ltd.* ***Tel:*** *0934 22044/417789.* ***Originality:*** *4/10.* ***Realism:*** *9/10.* ***Playability:*** *6/10.* ***Value:*** *9/10.*



CHAMELEON

In what Electric Dreams describe as a "surreal" arcade adventure, you are Chameleon. Made from Man and Flux, the fabric of limbo, you must enter the four realms of Fire, Earth, Air and Water and do battle with the demons that now rule there. These demons were created by an evil man to master the powers of nature and so wreak havoc on to the Earth with freak storms, blizzards and dust storms.

Using your flux you can match the demons and defeat them in combat while repairing the damage caused by the tainted flux.

During your quest you must journey through these strange realms and seek out the tainted flux that can be found only in a certain place and a specific time of day. Luckily, you are fitted with warning buzzes that sound when you meet one of the criteria, then it's merely a matter of fighting off the demon onslaught until you can progress to the next realm.

The game features a similar mock 3D display as found in Gremlin's Way of the Tiger as the Chemeleon travels past an assortment of energy draining pools and holes and



background deserts, pyramids, trees and mountains.

Constant attacks from the demon flames, rockslabs, twisters, blizzards and dustballs drains your flux energy lifeforce which can be replenished by collecting the sparklers that are left if you blast the Super Demons.

Underneath this surreal coat of realms, flux and Limbo lies a surprisingly easy, shallow and ordinary arcade adventure. **T.H.**

Touchline

*Title: Chameleon. **Supplier:** Electric Dreams, 31 Carlton Crescent, Southampton SO1 2EW. **Tel:** 0703 229694. **Machine:** C64.*
***Originality:** 6/10. **Graphics:** 5/10. **Playability:** 7/10. **Value:** 6/10.*

HEARTLAND

The strangest things can happen when you read a book that you found in the attic. This one was all about an overweight wizard that saved a magic land from the evil antics of the Warlock Midan. As you near the end of the book you realise that the last six pages are missing! Then to your horror you find yourself in the land you were reading about and dressed in the wizard's outsize clothes and armed only with a self repeating top hat.

Your mission is to search the strange platforms and portals of the Heartland for the missing pages so that the story (and Heartland) has a happny ending. However Midan knows of your presence and has sent his minions to get you. These consist of the spitting wizards and the indestructable gooches that chase you even after you've blasted them into a pile of bones.

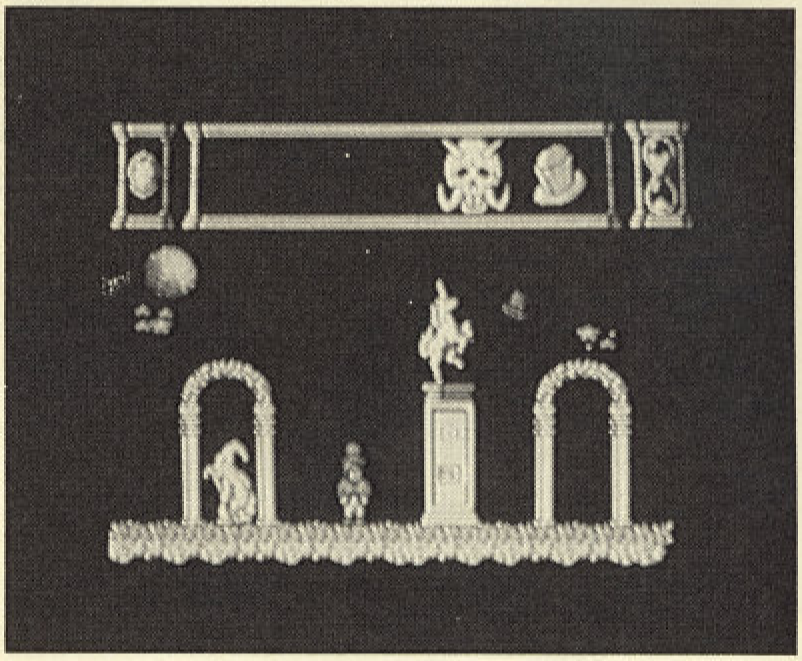
Your mission is further hampered by the energy draining stars and bubbles that float above the platforms and six dark pages that detail a different end to the book involving lots of GBH for you and the Heartland.

Help is at hand in the more powerful weapons that you can find such as swords and fireballs as well as other stars that give you temporary immunity and a bed that transports you from one scene to another. Despite this the hand of Midan isn't far away and gets even closer every time one of his minions or spells touch you until his face appears at the top of the screen ending your game.

Heartland is an excellent arcade adventure featuring some exceptional graphics particularly of the crumbling minions as they disperse into a pile of bones. **T.H.**

Touchline

*Title: Heartland. **Supplier:** Odin, First Floor, 74 New Oxford Street, London WC14 1PS. **Machine:** C64.*
***Originality:** 7/10. **Graphics:** 9/10. **Playability:** 7/10. **Value:** 8/10.*



SKY RUNNER

By the 21st Century man was spread throughout the galaxy and at last the governments had found a drug to control him.

This was the result of years of research and countless failures as previous drugs had left guinea pigs in a brainless daze. Then on a single planet called Niabmoloc they actually found it growing on trees. Seventy per cent of the planets trees had fruit containing the drug Sky.

Fleets of Sky Runners riding their Sky Bikes were despatched to harvest the drug protected by the laser firing towers that were built to protect them.

Although necessary (normal policing methods didn't work) control drugs were still illegal. You are part of the Runner Squad that was formed to sabotage the Sky running on the forested world.

As you're paid by results you set off to trash as many bikers as possible. The game begins as your skimmer lands on the planet.

Your first problem is to take out the laser towers that protect the Sky collecting bikers. With your single skimmer you must out gun the towers by blasting them in high speed attack runs. Only then can you land and drop your first of three bikes.

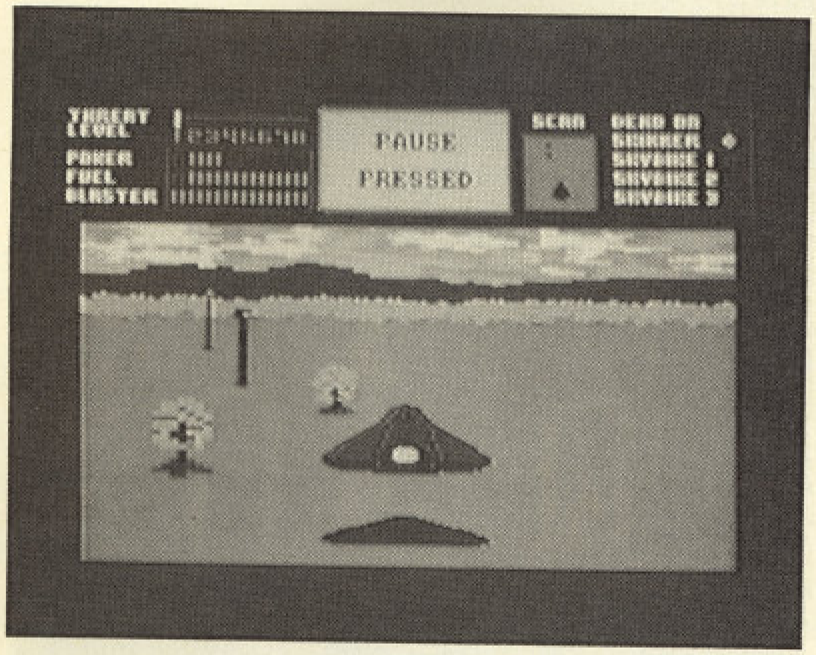
Charging through the trees (that are as deadly as the towers if you crash into them) you must track down and

destroy the Sky Bikers but you must take care not to destroy your fellow runner squad men.

Unfortunately, even the eight different threat or skill levels do nothing to save a game that is bland and reminiscent of a four year old Spectrum game! **T.R.H.**

Touchline

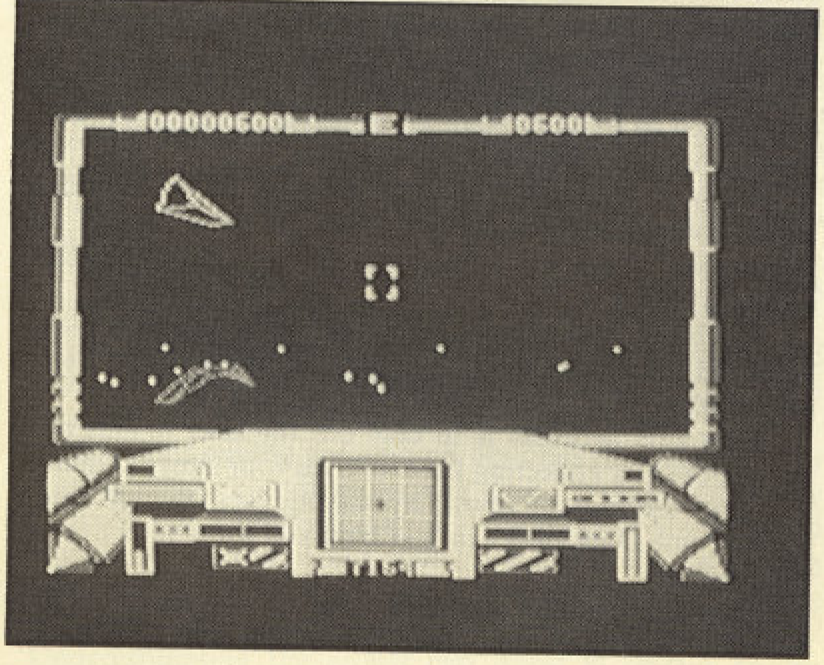
Title: *Sky Runner.* ***Supplier:*** *Cascade Games, Harrogate, HG1 5BG.* ***Machine:*** *C64.*
Originality: *4/10.* ***Graphics:*** *6/10.* ***Playability:*** *5/10.* ***Value:*** *5/10.*



STARGLIDER

Starglider, the game that features vector graphics arcade action, comes in a box with a 64 page novel, poster and key guide and won every possible accolade in its previous versions, is at last available on the C64.

The Star Glider in question isn't the craft that you fly by peering at its on screen controls but giant birds that lead to the downfall of the planet Novenia. These birds migrated through space to Novenia and were fried by the planets Sentinel "zap anything" defence system until an attack of conservation reprogrammed the Sentinels. Unfortunately, they also let in the Star Glider shaped Ergon attack fleet that devastated the defenceless planet. Luckily, you were on a nearby moon and have found an ancient airbourne ground attack vehicle (AGAV) and have gone to the rescue.



There's no great strategic aim to be fulfilled as your job is simply to destroy all you can before they finally get you. You find you can use the planet's refuel, rearm and repair facilities that should improve your chances.

Using a combination of keyboard and joystick controls you must fly your AGAV and do battle with a collection of alien craft that include the Star Wars inspired walkers and stompers, tanks, mines, missile launchers and he flapping Star Gliders. Most take more than one shot to kill and some such as the stompers can only be destroyed by firing a missile that you must guide to the target through a separate display.

An excellent game that has been ruined by poor programming. **T.H.**

Touchline

Title: *Starglider.* ***Supplier:*** *Rainbird, 1st Floor, 74 New Orford Street, London WC1A 1PS.* ***Machine:*** *C64.* ***Price:*** *£14.95.*
Originality: *8/10.* ***Graphics:*** *7/10.* ***Playability:*** *4/10.* ***Value:*** *6/10.*

10th FRAME

Ten pin bowling is the name of the game in this latest sports simulation from the Access/US Gold stable. 10th Frame allows up to eight players to have a go at knocking over as many skittles as possible on either a league or one off basis.

For the uninitiated, ten pin bowling involves rolling a huge ball down an alley as you attempt to knock over 10 skittles. You get two attempts to do this. If you succeed in knocking them all down with only one ball, this is known as a strike. Take two balls and it becomes a spare. The secret of a high score is to make sure of getting your spares.

In order to launch a ball, you must first select an aiming point and position your man on the lane. Keeping the fire button pressed will start a bar moving up a scale as you determine the speed of your release. Two small markers determine the safe upper and lower limits for an accurate throw. The bar then slides quickly down the right hand side of the scale and you must press again to stop on one of the three markers – straight, slight hook and maximum hook. Miss your press and your ball is likely to make an early roll into the nearest gutter.

Graphically, the game is a little disappointing. The effects of the skittles falling down is well done but the lane is small – one fifth the width of the screen. The worst part is the sliding scale. Yellow on orange proved very hard to see, especially under artificial light.

10th Frame is a highly accurate simulation of 10 pin bowling but lacks a little in addictive qualities. **G.R.H.**
Touchline:
Title: *10th Frame.* ***Supplier:*** *US Gold, Units 2/3, Holford Way, Holford, Birmingham B6 7AX.* ***Machine:*** *C64.* ***Price:*** *£9.95.* ***Originality:*** *8/10.* ***Graphics:*** *6/10.* ***Playability:*** *7/10.* ***Value:*** *7/10.*

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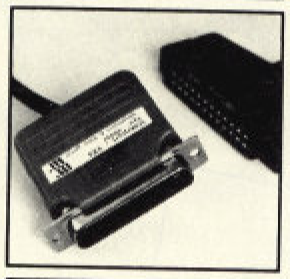
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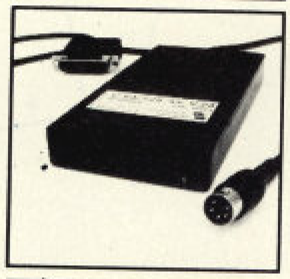
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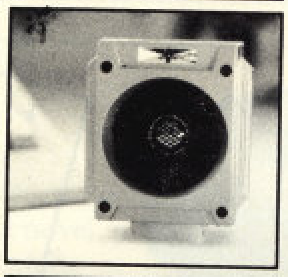
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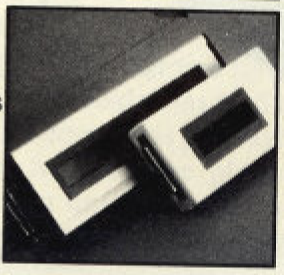
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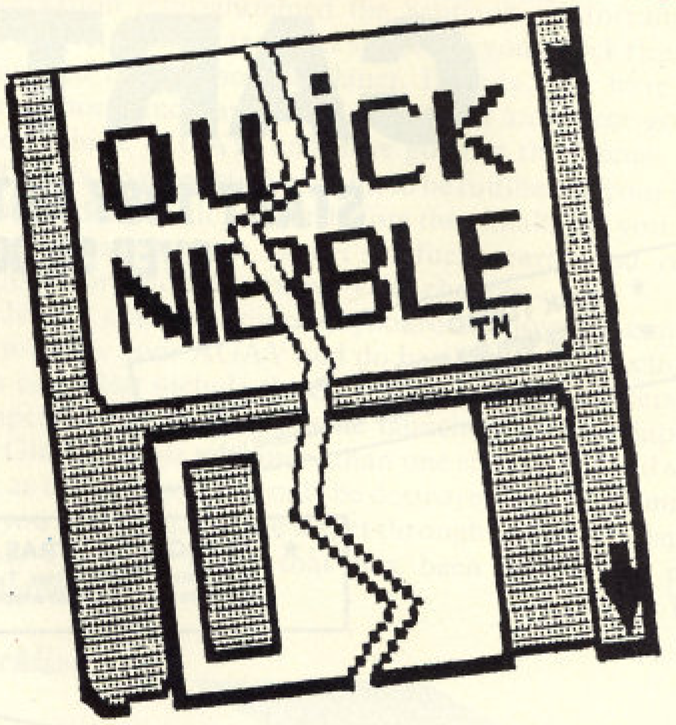
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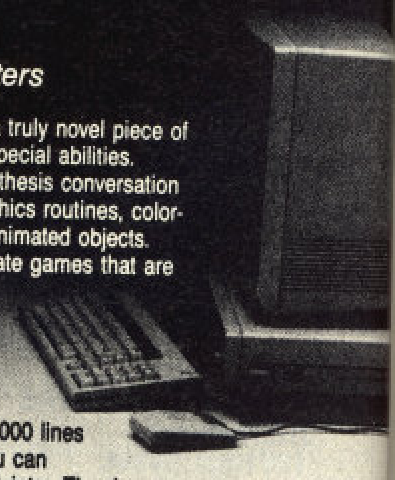


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Cribbage

If you've ever played cribbage then you'll know just what an addictive game it is and if you haven't then try our Plus/4 version of the game

By Hugh McGhee

Crib is one of the most popular pub card games in this country, but have you ever considered trying to beat your computer instead of battling against the champ down at your local? Now's your chance, if you've got a Plus/4.

Instructions

It is assumed that the player knows how to play cribbage. The rules are exactly those given in *Hoyle's Rules of Games*. Since some aspects of scoring points very from region to region, the points scored in this version will be re-iterated in this introduction. The following points should thus be noted.

1) Due to the layout of the cards X is used to represent a 10.

2) Input is handled by means of a joystick in port two. When asked to play or discard a card, simply move the marker which appears above the cards to the required position and press the fire button. When entering your points,moving the joystick < right > and < left > increases and decreases the points counter respectively. Once again pressing fire enters your response. The program is protected against attempts to discard or play the same card twice. Attempts to claim too many points produce an error message. The Plus/4 always claims the correct number of points for itself but, if you don't claim all your points, the Plus/4 will steal them.

3) Each player is dealt six cards and must discard two cards into the crib. The Plus/4 plays a simple strategy choosing its best four cards after consideration of the two cards it is discarding. The cards are shuffled after every hand but only cards are shuffled out of the pack to save time. The program differentiates between dealer and non-dealer. The player who doesn't have the crib always receives the first card.

4) The Plus/4 cuts the cards for the initial crib. The lowest card wins. Note that in this game the ace always counts as one. Illegal combinations are not allowed so two aces of spades, for example, will not be displayed. Ties however, such as both players cutting a two of different suits, are permitted, in which case the cut will be performed again.

5) The first player to obtain 121 points or more wins.

6) Note that in the run up the Plus/4 will check your cards if you say you can't go. This is the only time the Plus/4 examines your cards but it does not cheat. Any discovery of an ability to play after entering 'can't go' will produce an error message, as will an attempt to play a card that would result in a total excess of 31. The Plus/4 does not play a strategy in the run up except that it will always make the total 31 if it can. It will not, however, always make the total 15 even if it can.

7) The ending of a go in the run up has proved the most tricky operation in practice. If the player plays last the Plus/4 does not know that the player cannot go unless the total is 31 or the last card has been played. Otherwise the player must enter 'can't go' before entering the last point.

Points are scored as follows:

A) Two points for any pairs, six points for three cards of a kind and 12 points for four cards of a kind.
B) Two points for any combination of cards totalling 15, counting picture cards as 10.
C) For any run of three or more cards, count one point for each card in the run.
D) For obtaining a total of 15 or 31 in the run up, score two points.
E) For playing the last card in any go in the run up, score one point.
F) For a flush of four cards in your hand, score four points. Note there are no points for a flush or four in the crib.
G) For a flush of five, either in your hand or in the crib, score five points.
H) If the starter card is a jack, and it is your crib, add two points when counting your hand in the main game.
I) If you have a jack either in your hand or in the crib of the same suit as the starter card, count one point.

8) The game is played on the high resolution screen to facilitate the different background colours.

Variables

The array CA$(m,n) has four rows and

14 columns. Columns one to 13 hold hold the denominations of the cards from ace through to king. The zero element of each row holds the suit for that row. The suits are, in order, spades, hearts, clubs and diamonds.

The 13 cards shuffled out of the pack for each hand are placed in the SD$(m,n) array. This has two rows of 13 columns, row zero holding the denomination of the cards and row one their respective suits.

The array C$(m,n) has four rows and six columns. This holds the initial six cards dealt to each player. The Plus/4's denominations and suits are in rows zero and one respectively, the denominations and suits of the player's cards are in rows two and three respectively.

The array F$(m,n) is used after the discard has taken place. It has six rows of five columns and is the major card array used in the game. The first four elements in rows zero, two and four hold the denominations of the four cards in the Plus/4's hand, player's hand and the crib respectively. The associated suits are stored in the first four elements of rows one, three and five. At the commencement of the main game the fifth element of each relevant row will be occupied by the denomination and suit of the starter card, which is used by all hand.

The face values for the deck of cards are stored in the array P%(m,n) row zero holding the values one (for the ace) to 13 (for the king), whereas row one holds the values one to 10 (for the purpose of counting 15s).

The respective values of the shuffled cards are placed in the array S%(m,n) after shuffling. The values are transfered to C%(m,n) after dealing the cards and are finally stored in the V%(m,n) array after the discard. The arrays S%(m,n) and V%(m,n) have exactly the same format as the S$(m,n) and F$(m,n) arrays described above.

The array R%(m,n) is used by the sorting routine for run checks. The unsorted cards are placed in row one and after transfer by the sorting routine into row zero. That row is sorted into ascending order.

The arrays M%(m) and Y%(m) are row vectors each containing four elements. These arrays are used in the run up, and, a non-zero element indicates a played card. As is general in this program, any variable prefixed by the letter M indicates a value used by the Plus/4, whereas variables associated with the player are prefixed with a Y. YC

The major scalar variables are as follows:

MP—	Plus/4's points
YP—	Player's points
TP—	Used in run up to indicate number of cards played in the current go.
T—	Used in total the points in the points count routine. Also used in the run up to hold the total face values in the current go.
PO—	Used in the main game to hold the total points count being the sum of T above and the result of checks for flushes, jacks etc. Also used to hold points scored in the run up as T is otherwise engaged.
ML—	Flag used to indicate who played the current card in the run up. If ML is one then the PLus/4 played last, and if ML equals two the player did.
IC—	Flag used in the run up to indicate whether or not the Plus/4 can play a card. The Plus/4 is able to play a card whilst IC is equal to one and unable to go if equal to zero.
YC—	Serves the same purpose as IC for the player.
MG, YG—	These two variables hold the number of cards played in the run up by the Plus/4 and the player respectively.
WC—	Signifies who holds the crib. If set to one then the Plus/4 has the crib and if set to two the player has the crib.

PROGRAM: CRIBBAGE

```
1000 DEF FNA(Z)=INT(RND(1)*Z)+1
1010 GOSUB3360:GOSUB4390
1020 GOSUB3710:GOSUB3470
1030 DO
1040 :GOSUB3770
1050 :GOSUB4060:GOSUB3860:GOSUB1
900
1060 :IFMP>120ORYP>120THEN1080
1070 :GOSUB1100:GOSUB3470
1080 LOOPUNTILMP>120ORYP>120
1090 GOTO4530
1100 TP=4:R=2:W=9:Q$=SD$(0,12):S
$=SD$(1,12):GOSUB2470
1110 FORA=0TO4STEP2
1120 :F$(A,4)=Q$:F$(A+1,4)=S$:V%
(A,4)=P%(0,12):V%(A+1,4)=P%(1,12
)
1130 NEXT
1140 IFWC=2THEN1210
1150 A=2:PO=0:GOSUB1320:IFYP>120
THEN1300
1160 B=40:R=18:S=24:C=0:GOSUB333
0
1170 S$="FOR ME":A=0:PO=0:GOSUB1
430:IFMP>120THEN1300
1180 A=0:W=0
1190 FORR=16TO37STEP7:S$=F$(5,A)
:Q$=F$(4,A):GOSUB2470:A=A+1:NEXT
1200 S$="IN THE CRIB FOR ME":A=4
:PO=0:GOSUB1490:WC=2:GOTO1270
1210 S$="FOR ME":A=0:PO=0:GOSUB1
440:IFMP>120THEN1300
1220 B=40:C=0:R=0:S=6:GOSUB3330
1230 A=2:PO=0:GOSUB1310:IFYP>120
THEN1300
1240 A=0:W=18
1250 FORR=16TO37STEP7:S$=F$(5,A)
:Q$=F$(4,A):GOSUB2470:A=A+1:NEXT
1260 EP=9:A=4:PO=0:GOSUB1370:WC=
1
1270 IFWC=1THENR=18:S=24:ELSER=0
:S=6
1280 B=40:C=0:GOSUB3330:B=14:R=9
:S=9:GOSUB3330
1290 B=5:R=10:S=14:GOSUB3330:B=1
6:R=15:S=R:GOSUB3330
1300 RETURN
1310 IFF$(A,4)="J"THENPO=PO+2
1320 B=1:Q$=F$(A+1,0)
1330 FORC=1TO4
1340 IFF$(A+1,C)=Q$THENB=B+1
1350 NEXT
1360 IFB=4ANDF$(A+1,4)<>Q$THENPO
=PO+4:ELSEIFB=5THENPO=PO+5
1370 FORB=0TO3
1380 IFF$(A,B)="J"ANDF$(A+1,B)=F
$(A+1,4)THENPO=PO+1:B=4
1390 NEXT
1400 FORB=0TO4:R%(0,B)=V%(A,B):R
%(1,B)=V%(A+1,B):NEXT
1410 GOSUB1600
1420 PO=PO+T:GOTO2710
1430 IFF$(0,4)="J"THENPO=PO+2
1440 B=1:Q$=F$(A+1,0)
1450 FORC=1TO4
1460 IFF$(A,C)=Q$THENB=B+1
1470 NEXT
1480 IFB=4ANDF$(A+1,4)<>Q$THENPO
=PO+4:ELSEIFB=5THENPO=PO+5
1490 FORB=0TO3
1500 IFF$(A,B)="J"ANDF$(A+1,B)=F
$(A+1,4)THENPO=PO+1
1510 NEXT
1520 FORB=0TO4:R%(0,B)=V%(A,B):R
%(1,B)=V%(A+1,B):NEXT
1530 GOSUB1600:PO=PO+T
1540 IFPO=0THENQ$="NO POINTS "+S
$:GOTO1560
1550 Q$=STR$(PO):IFPO>1THENQ$=Q$
+" POINTS "+S$:ELSEQ$=Q$+" POINT
 "+S$
1560 CHAR,7,12,Q$
1570 FORA=1TO2000:NEXT
1580 IFPO>0THENSOUND1,930,18:MP=
```

```
MP+PO:R=36:S=9:P=MP:GOSUB3350
1590 B=29:R=12:S=R:C=7:GOSUB3330
:RETURN
1600 B=0:GOSUB3240:T=0:A=1
1610 FORB=0TO3:IFR%(0,B)+1=R%(0,
B+1)THENA=A+1:NEXT
1620 IFA=5THENT=5:GOTO1750
1630 IFR%(0,0)+1=R%(0,1)ANDR%(0,
1)+1=R%(0,2)ANDR%(0,2)+1=R%(0,3)
THENT=T+4
1640 IFR%(0,0)+1=R%(0,1)ANDR%(0,
1)+1=R%(0,2)ANDR%(0,2)+1=R%(0,4)
THENT=T+4
1650 IFR%(0,0)+1=R%(0,1)ANDR%(0,
1)+1=R%(0,3)ANDR%(0,3)+1=R%(0,4)
THENT=T+4
1660 IFR%(0,0)+1=R%(0,2)ANDR%(0,
2)+1=R%(0,3)ANDR%(0,3)+1=R%(0,4)
THENT=T+4
1670 IFR%(0,1)+1=R%(0,2)ANDR%(0,
2)+1=R%(0,3)ANDR%(0,3)+1=R%(0,4)
THENT=T+4
1680 IFT=4THEN1750:ELSEIFT>4THEN
1720
1690 FORB=0TOTP-2:FORC=B+1TOTP-1
:FORD=C+1TOTP
1700 IFR%(0,B)+1=R%(0,C)ANDR%(0,
C)+1=R%(0,D)THENT=T+3
1710 NEXTD,C,B
1720 FORA=0TOTP-1:FORB=A+1TOTP
1730 IFR%(0,A)=R%(0,B)THENT=T+2
1740 NEXTB,A
1750 A=0
1760 FORB=0TOTP:A=A+R%(1,B):NEXT
1770 IFA=15THENT=T+2:GOTO1890:EL
SEIFA<15THEN1890
1780 IFTP<4THEN1830
1790 FORA=0TO1:FORB=A+1TO2
1800 FORC=B+1TO3:FORD=C+1TO4
1810 IFR%(1,A)+R%(1,B)+R%(1,C)+R
%(1,D)=15THENT=T+2
1820 NEXTD,C,B,A
1830 FORA=0TOTP-2:FORB=A+1TOTP-1
:FORC=B+1TOTP
1840 IFR%(1,A)+R%(1,B)+R%(1,C)=1
5THENT=T+2
1850 NEXTC,B,A
1860 FORA=0TOTP-1:FORB=A+1TOTP
1870 IFR%(1,A)+R%(1,B)=15THENT=T
+2
1880 NEXTB,A
1890 RETURN
1900 CHAR,10,12,"        RUN UP.
..":FORA=1TO1645:NEXT:CHAR,18,12
,"             "
1910 CHAR,30,12,"TOTAL:"
1920 EP=0:T=0:MG=0:YG=0:IC=1:YC=
1:TP=0:ML=WC
1930 R=37:S=12:P=T:GOSUB 3350:C=
0
1940 R=18:S=R:Q$="[c A][s C][s C
][c S]":GOSUB3340:R=19:S=21:Q$="
[s B]  [s B]":GOSUB3340
1950 R=22:S=R:Q$="[c Z][s C][s C
][c X]":GOSUB3340:R=1:S=20:P=0:G
OSUB3350
1960 R=23:S=R:Q$="PTS.":GOSUB334
0:C=6:R=18:S=R:Q$="CAN'T":GOSUB3
340
1970 C=7:R=19:S=R:Q$="GO":GOSUB3
340
1980 DO
1990 PO=0
2000 IFML=1ANDYC=1THENGOSUB2540:
GOTO2060
2010 IFML=2ANDIC=1THENGOSUB2120:
GOTO2060
2020 IFML=1ANDYC=0ANDIC=1THENGOS
UB2120:GOTO2060
2030 IFML=2ANDIC=0ANDYC=1THENGOS
UB2540:GOTO2060
2040 IFIC=0ANDYC=0ANDEP=0THENPO=
1:ONMLGOSUB2260,2710
2050 EP=0:T=0:TP=0:IC=1:YC=1:CHA
R,37,12,"  ":P=T:R=37:S=12:GOSUB
 3350
2060 LOOPUNTILMG+YG=8ORMP>120ORY
P>120
2070 C=6:R=18:S=19:B=5:GOSUB3330
2080 C=16:R=7:S=7:B=23:GOSUB3330
2090 R=16:S=R:GOSUB3330
2100 B=32:C=7:R=12:S=R:GOSUB3330
2110 RETURN
2120 IFMG=4THEN2450
2130 IFT>4ANDT<15THEN2310:ELSEIF
T>20THEN2360
2140 DO:A=FNA(4)-1:LOOPUNTILM%(A
)=0
2150 W=0:S$=F$(1,A):Q$=F$(0,A)
2160 R=(A+2)*5+(A*2)+6:GOSUB2470
:S=7:P=MG+1:GOSUB3350
2170 TP=TP+1:MG=MG+1:M%(A)=1
2180 T=T+V%(1,A):R=37:S=12:P=T:G
OSUB3350
2190 R%(1,TP)=V%(0,A)
2200 ML=1
2210 IFMG+YG=8OR(MG=4ANDYC=0)THE
NPO=PO+1:IC=0:YC=0:EP=1
2220 IFT=15THENPO=PO+2
2230 IFT=31THENPO=2:IC=0:YC=0:EP
=1
2240 IFTP>1THENGOSUB2970:ELSEIFP
O=0THEN2290
2250 IFPO=0THENCHAR,8,12,"NO POI
NTS FOR ME":GOTO2290
2260 IFPO>0THENSOUND1,930,18:MP=
MP+PO:P=MP:R=36:S=9:GOSUB3350
2270 Q$=STR$(PO):IFPO=1THENQ$=Q$
+" POINT FOR ME":ELSEQ$=Q$+" POI
NTS FOR ME"
2280 CHAR,7,12,Q$
2290 FORA=1TO1645:NEXT
2300 RETURN
2310 A=5:B=3
2320 DOWHILEB>=0
2330 IFT+V%(1,B)=15ANDM%(B)=0THE
NA=B:EXIT:ELSEB=B-1
2340 LOOP
2350 IFA<5ANDRND(1)>.5THEN2150:E
LSE2140
2360 A=5:B=0:C=5
2370 DOWHILEB<4
2380 IFT+V%(1,B)=31ANDM%(B)=0THE
NA=B:EXIT
2390 IFT+V%(1,B)<32ANDM%(B)=0THE
NC=B
2400 B=B+1
2410 LOOP
2420 IFA<5THEN2150:ELSEIFC<5THEN
A=C:GOTO2150
2430 CHAR,8,12,"I CAN'T GO
"
2440 FORA=1TO1645:NEXT
2450 IC=0:IFYC=0ANDML=1ANDEP=0TH
ENPO=1:EP=1:GOTO2260
2460 RETURN
2470 COLOR0,2
2480 CHAR,R-2,W,"[s O][c Y][c Y]
[c Y][s P]":CHAR,R-2,W+6,"[s L][
c P][c P][c P][s @]"
2490 FORY=W+1TOW+5:CHAR,R-2,Y,"[
c H]    [c N]":NEXT
2500 IFS$="[s S]"ORS$="[s Z]"THE
NCOLOR1,3,5
2510 CHAR,R-1,W+1,S$:CHAR,R+1,W+
5,S$:CHAR,R,W+3,Q$
2520 IFS$="[s S]"ORS$="[s Z]"THE
NCOLOR1,1
2530 COLOR0,6,5:RETURN
2540 IFYG=4THEN2950
2550 CHAR,8,12,"YOU TO PLAY
"
2560 Q$="V":X=9:Y=17:C=9:D=37:S=
7
2570 GOSUB4630:IFX=9THEN2900:ELS
EC=(X-2)/7-2
2580 IFY%(C)<>0THEN2890
2590 IFT+V%(3,C)>31THEN2880
2600 R=X:S=16:P=YG+1:GOSUB3350
2610 TP=TP+1:Y%(C)=1:YG=YG+1
2620 R%(1,TP)=V%(2,C)
2630 T=T+V%(3,C):R=37:S=12:P=T:G
OSUB3350
2640 ML=2
2650 IFYG+MG=8OR(YG=4ANDIC=0)THE
NPO=PO+1:EP=1
2660 IFT=15THENPO=PO+2
2670 IFT=31THENPO=2:IC=0:YC=0:EP
=1
2680 IFTP>1THENGOSUB2970
2690 IFTP>1ORPO>0THENGOSUB2710
2700 RETURN
2710 CHAR,8,12,"ENTER NO. OF POI
NTS ":IFEP=9THENCHAR,28,12,"IN C
RIB"
2720 F=99:R=1:S=20:P=0:GOSUB4630
:F=0
2730 CHAR,8,12,"
     ":IFEP=9THENCHAR,28,12,"
  "
2740 IFP=POTHEN2830:ELSEIFP>POTH
EN2820
2750 R=PO-P:Q$="I CLAIM"+STR$(R)
+" ":IFR>1THENQ$=Q$+"POINTS":ELS
EQ$=Q$+"POINT"
2760 CHAR,8,12,Q$
2770 FORA=1TO1645:NEXT
2780 CHAR,8,12,"
  "
2790 YP=YP+P:MP=MP+R
2800 P=MP:R=36:S=9:GOSUB3350:SOU
ND1,930,18:IFMP>120THENYP=0:RETU
RN
2810 GOTO2840
2820 CHAR,8,12,"I MAKE IT LESS!"
:SOUND1,20,70:FORA=1TO1645:NEXT:
GOTO2710
2830 YP=YP+PO
2840 IFPO>0THENSOUND1,930,18:R=3
6:S=15:P=YP:GOSUB3350
2850 FORA=1TO500:NEXT
2860 CHAR,1,20,"0 "
2870 RETURN
2880 CHAR,8,12,"TOTAL OVER 31!":
FORA=1TO1645:NEXT:GOTO2550
2890 CHAR,8,12,"THAT'S CHEATING!
!":FORA=1TO1645:NEXT:GOTO2550
2900 A=0:B=5:DOWHILEA<4
2910 IFY%(A)=0ANDT+V%(3,A)<32THE
NB=A:EXIT:ELSEA=A+1
2920 LOOP
2930 IFB=5THEN2950
2940 CHAR,8,12,"OH YES YOU CAN!!
":FORA=1TO1645:NEXT:GOTO2550
2950 YC=0:IFIC=0ANDML=2ANDEP=0TH
ENPO=1:EP=1:GOTO2710
2960 RETURN
2970 IFTP=2THEN3140
2980 B=1:GOSUB3230:L=0:D=1
2990 FORC=BTOTP-1
3000 IFR%(0,C)+1<>R%(0,C+1)ANDR%
(0,C)<>R%(0,C+1)THEND=1:GOTO3030
3010 IFR%(0,C)<>R%(0,C+1)THEND=D
+1
3020 IFD>2THENL=D
3030 NEXT
3040 IFL=TPTHEND=L:GOTO3130
3050 IFL=0THEN3140
3060 DO
3070 B=TP-L+1:GOSUB3230:D=1
3080 FORC=BTOTP-1
3090 IFR%(0,C)+1=R%(0,C+1)THEND=
D+1
```

```
3100 NEXT
3110 IFD>2ANDD<>LTHENL=D:GOTO307
0
3120 LOOPUNTILD<3ORD=LORB>TP-2
3130 IFD=LTHENPO=PO+L:RETURN
3140 L=1:C=TP:B=TP-1
3150 DO
3160 IFR%(1,B)=R%(1,C)THENL=L+1:
B=B-1
3170 LOOPUNTILB<1ORB<TP-3ORR%(1,
B)<>R%(1,C)
3180 IFL=1THEN3220
3190 IFL=2THENPO=PO+2
3200 IFL=3THENPO=PO+6
3210 IFL=4THENPO=PO+12
3220 RETURN
3230 FORC=BTOTP:R%(0,C)=R%(1,C):
NEXT
3240 DO
3250 D=0
3260 FORC=BTOTP-1
3270 IFR%(0,C)<=R%(0,C+1)THEN330
0
3280 R=R%(0,C):R%(0,C)=R%(0,C+1)
3290 R%(0,C+1)=R:D=D+1
3300 NEXTC
3310 LOOPUNTILD=0
3320 RETURN
3330 Q$="":FORA=1TOB:Q$=Q$+" ":N
EXT
3340 FORA=RTOS:CHAR,C,A,Q$:NEXT:
RETURN
3350 CHAR,R,S,RIGHT$(STR$(P),LEN
(STR$(P))-1):RETURN
3360 DIM F$(5,4),C$(3,5),C%(3,5)
,R%(1,8),M%(3),Y%(3)
3370 DIM V%(5,4),CA$(3,13),SD$(1
,12),P%(1,12):VOL7
3380 CA$(0,0)="[s A]":CA$(1,0)="
[s S]"
3390 CA$(2,0)="[s X]":CA$(3,0)="
[s Z]"
3400 FORA=0TO3
3410 RESTORE4870
3420 FORB=1TO13
3430 READCA$(A,B)
3440 NEXTB,A
3450 FORA=0TO3:Y%(A)=0:M%(A)=0:N
EXT
3460 RETURN
3470 FORC=0TO12
3480 DO:A=INT(RND(1)*4):B=INT(RN
D(1)*13)+1:LOOPUNTILCA$(A,B)<>""
3490 SD$(0,C)=CA$(A,B):SD$(1,C)=
CA$(A,0)
3500 IFB<10THENP%(1,C)=B:ELSEP%(
1,C)=10
3510 P%(0,C)=B:CA$(A,B)=""
3520 NEXT
3530 GOSUB3400:A=0
3540 IFWC=1THEN3630
3550 FORC=0TO10STEP2
3560 C$(0,A)=SD$(0,C):C$(1,A)=SD
$(1,C)
3570 C%(0,A)=P%(0,C):C%(1,A)=P%(
1,C)
3580 C$(2,A)=SD$(0,C+1):C$(3,A)=
SD$(1,C+1)
3590 C%(2,A)=P%(0,C+1):C%(3,A)=P
%(1,C+1)
3600 A=A+1
3610 NEXT
3620 GOTO3700
3630 FORC=0TO10STEP2
3640 C$(2,A)=SD$(0,C):C$(3,A)=SD
$(1,C)
3650 C%(2,A)=P%(0,C):C%(3,A)=P%(
1,C)
3660 C$(0,A)=SD$(0,C+1):C$(1,A)=
SD$(1,C+1)
3670 C%(0,A)=P%(0,C+1):C%(1,A)=P
%(1,C+1)
3680 A=A+1
3690 NEXT
3700 RETURN
3710 CHAR,6,10,"[c A][s *][s *][
s *][s *][s *][s *][s *][s *][s
*][s *][s *][s *][s *][s *][s *]
[s *][s *][s *][s *][s *][s *][s
 *][s *][s *][s *][s *][s *][s *
][s *][s *][s *][s *][c S]"
3720 FORY=11TO13:CHAR,6,Y,"[s B]

[s B]":NEXT
3730 CHAR,6,14,"[c Z][s *][s *][
s *][s *][s *][s *][s *][s *][s
*][s *][s *][s *][s *][s *][s *]
[s *][s *][s *][s *][s *][s *][s
 *][s *][s *][s *][s *][s *][s *
][s *][s *][s *][s *][c X]"
3740 CHAR,31,9,"ME :"+STR$(MP)
3750 CHAR,30,15,"YOU :"+STR$(YP)
3760 RETURN
3770 A=0:W=18
3780 FORR=2TO37STEP7
3790 Q$=C$(2,A):S$=C$(3,A):GOSUB
2470
3800 FORY=0TO6:CHAR,R-2,Y,"[c +]
[c +][c +][c +][c +]":NEXT
3810 A=A+1
3820 NEXT
3830 FORY=9TO15:CHAR,0,Y,"[c +][
c +][c +][c +][c +]":NEXT
3840 IFWC=1THENCHAR,7,9,"MY CRIB
":ELSECHAR,7,15,"YOUR CRIB"
3850 RETURN
3860 CHAR,10,12,"DISCARD TWO CAR
DS        ":L=0:P=2
3870 Q$="V":X=2:Y=17:C=2:D=37:S=
7
3880 GOSUB4630:C=(X-2)/7
3890 IFC$(2,C)<>""THEN3920
3900 SOUND1,20,70:CHAR,8,12,"YOU
 CAN'T DISCARD IT TWICE"
3910 FORR=1TO1645:NEXT:CHAR,8,12
,"                        ":GO
TO3870
3920 F$(4,P)=C$(2,C):F$(5,P)=C$(
3,C):C$(2,C)="":SOUND 1,930,12
3930 V%(4,P)=C%(2,C):V%(5,P)=C%(
3,C)
3940 L=L+1:P=P+1:IFL<2THEN3870
3950 A=0
3960 FORB=0TO5
3970 IFC$(2,B)=""THEN4010
3980 F$(2,A)=C$(2,B):F$(3,A)=C$(
3,B)
3990 V%(2,A)=C%(2,B):V%(3,A)=C%(
3,B)
4000 A=A+1
4010 NEXT
4020 B=14:R=18:S=24:C=0:GOSUB333
0:W=18:A=0
4030 IFC$(2,0)=""ANDC$(2,1)=""TH
EN4050
4040 FORR=16TO37STEP7:Q$=F$(2,A)
:S$=F$(3,A):GOSUB2470:A=A+1:NEXT
4050 RETURN
4060 CHAR,10,12,"PLEASE WAIT I'M
 THINKING"
4070 B=0:TP=3:BT=0
4080 FORX=0TO2:FORY=X+1TO3
4090 FORP=Y+1TO4:FORL=P+1TO5
4100 R%(0,0)=C%(0,X):R%(0,1)=C%(
0,Y):R%(0,2)=C%(0,P):R%(0,3)=C%(
0,L)
4110 R%(1,0)=C%(1,X):R%(1,1)=C%(
1,Y):R%(1,2)=C%(1,P):R%(1,3)=C%(
1,L)
4120 GOSUB3240
4130 IFR%(0,0)+1=R%(0,1)ANDR%(0,
1)+1=R%(0,2)ANDR%(0,2)+1=R%(0,3)
THENT=4:ELSET=0
4140 IFT>0THENGOSUB1750:ELSEGOSU
B1690
4150 F=0:MG=1:FORPO=0TO5
4160 IFPO=XORPO=YORPO=PORPO=LTHE
N4180
4170 IFMG=1THENR=PO:MG=2:ELSES=P
O
4180 NEXTPO
4190 IFC%(0,R)=C%(0,S)THENF=2:GO
TO4230
4200 IFABS(C%(0,R)-C%(0,S))<3THE
NF=1
4210 IFC%(1,R)+C%(1,S)=15THENF=F
+2
4220 IFC%(1,R)+C%(1,S)=5THENF=F+
1
4230 IFWC=1THENT=T+F:ELSET=T-F
4240 IFT>BTTHENBT=T:POKE208,R:PO
KE209,S
4250 NEXTL,P,Y,X
4260 IFBT=0THENR=0:S=1:ELSER=PEE
K(208):S=PEEK(209)
4270 F$(4,0)=C$(0,R):F$(5,0)=C$(
1,R)
4280 F$(4,1)=C$(0,S):F$(5,1)=C$(
1,S)
4290 V%(4,0)=C%(0,R):V%(5,0)=C%(
1,R)
4300 V%(4,1)=C%(0,S):V%(5,1)=C%(
1,S)
4310 A=0:FORB=0TO5
4320 IFB=RORB=STHEN4360
4330 F$(0,A)=C$(0,B):F$(1,A)=C$(
1,B)
4340 V%(0,A)=C%(0,B):V%(1,A)=C%(
1,B)
4350 A=A+1
4360 NEXT
4370 B=13:C=0:R=0:S=6:GOSUB3330
4380 RETURN
4390 A=RND(-TI):COLOR4,6,5:COLOR
0,6,5:COLOR1,1
4400 Q$="CUT FOR CRIB":GRAPHIC 1
:SCNCLR
4410 CHAR,1,1,Q$:CHAR,28,1,Q$
4420 CHAR,1,23,Q$:CHAR,28,23,Q$
4430 CHAR,19,1,"ME":CHAR,19,23,"
YOU"
4440 DO:A=INT(RND(1)*4):B=INT(RN
D(1)*13)+1
4450 :C=INT(RND(1)*4):D=INT(RND(
1)*13)+1:LOOPUNTILA<>CORB<>D
4460 R=20:W=4:Q$=CA$(A,B):S$=CA$
(A,0):GOSUB2470
4470 W=14:Q$=CA$(C,D):S$=CA$(C,0
):GOSUB2470
4480 IFB<DTHEN4500:ELSEIFB>DTHEN
4510
4490 CHAR,19,12,"TIE":FORA=1TO30
00:NEXT:CHAR,19,12,"   ":GOTO444
0
4500 CHAR,17,12,"MY CRIB":WC=1:G
OTO4520
4510 CHAR,16,12,"YOUR CRIB":WC=2
4520 GOSUB4720:SCNCLR:RETURN
4530 COLOR0,3,1:COLOR4,3,1:COLOR
1,3,5:GRAPHIC0,1
4540 IFMP>120THENCHAR,7,6,"[130]
YOU HAVE LOST...OF COURSE![132]"
4550 IFYP>120THENCHAR,8,6,"[130]
BEATEN...AND BY A HUMAN![132]"
4560 GOSUB4720
4570 CHAR,8,12,"A N O T H E R
G A M E ?"
4580 CHAR,8,14,"YES
         NO"
4590 Q$="[UPARROW]":X=9:Y=15:C=9
:D=32:S=23
4600 GOSUB4630
4610 IFX=9THENSOUND1,930,12:RUN
```

```
4620 SOUND1,930,12:FORA=1TO250:N
EXT:GRAPHIC0,1:NEW:END
4630 IFF<99THENCHAR,X,Y,Q$:ELSEG
OSUB3350:IFP<10THENCHAR,2,20," "
4640 DO:A=JOY(2):LOOPUNTILA=3ORA
=7ORA=128
4650 IFF<99THENCHAR,X,Y," "
4660 IFA=128THENRETURN
4670 IFA=3ANDF<99THENX=X+S:IFX>D
THENX=C
4680 IFA=7ANDF<99THENX=X-S:IFX<C
THENX=D
4690 IFA=3ANDF=99THENP=P+1:IFP>3
0THENP=0
4700 IFA=7ANDF=99THENP=P-1:IFP<0
THENP=30
4710 GOTO4630
4720 RESTORE
4730 FORA=1TO76
4740 IFA=19ORA=37THENRESTORE4800
4750 IFA=27ORA=55THENFORB=1TO30:
READC:NEXT
4760 READB,C,D:SOUND1,B,C:SOUND2
,B-2,C
4770 FORP=1TOD:NEXT
4780 NEXT
4790 RETURN
4800 DATA739,12,1,755,12,1,770,1
2,1,864,22,1,770,12,1,864,22,1,7
70,12,1,864,42
4810 DATA245,864,12,1,881,12,1,8
89,12,1,897,12,1,864,12,1,881,12
,1,897,22,1,854
4820 DATA12,1,881,22,1,864,67,1,
834,12,1,810,12,1,798,12,1,834,1
2,1,864,12,1,897
4830 DATA26,1,881,12,1,854,12,1,
834,12,1,881,52,1,864,12,1,881,1
2,1,889,12,1,897
4840 DATA12,1,864,12,1,881,12,1,
897,22,1,864,12,1,881,22,1,897,1
2,1,864,12,1,881
4850 DATA12,1,897,22,1,864,12,1,
881,22,1,897,12,1,864,12,1,881,1
2,1,897,22,1
4860 DATA854,12,1,881,22,1,864,9
8,1645
4870 DATAA,2,3,4,5,6,7,8,9,X,J,Q
,K
READY.
```

Diskit 4

To continue our special series for disk users, we bring you a routine which will foil those would be hackers from stealing your thunder.

By Les Allan

How often have you written a useful utility or program routine, given it to a 'friend' only to discover at a later time that somebody else has 'gone in' and taken the credits. Annoying isn't it!

Also there are a certain number of users that take delight in corrupting software by changing the text routines etc.

This program routine provides the user with the facility to scramble code thus making the would be hacker's job that much more difficult as the scrambled code disguises any text.

Getting It In

Make sure that sufficient room exists on the disk prior to 'booting' up 'PRG.SCRAMBLER'; occasionally one extra disk block is used on the saved file. Press any key on the keyboard to enter the scrambler code, enter the filename of the program to be scrambled and press RETURN to start the sequence.

The program is then loaded, scrambler and saved back to disk as '-FILENAME' where filename is the name of the program.

The routine adds 70 bytes to the saved code so the only limitation on this routine is that the original program must exist between $0801 and $CF8F. Even if 202 blocks are used there still may be sufficient room on the disk. As I am sure you are aware, each block is allocated 256 bytes but all may not be used.

Once the save process is completed the program exists in memory as the finished product and can be confirmed as successful by entering RUN.

The program must be typed in exactly as listed and saved prior to running. Error trap routines are included to ensure that the data as read is correct. The program, when run, stores the relevant code at a temporary address of $800 and when prompted relocates the working program to Basic ($0801) and saves the program to disk.

VG

```
PROGRAM: SCRAMBLER BOOT

A0  10 M1=32768:M2=34672:CH=0
97  11 PRINTCHR$(144)CHR$(147)
C3  12 POKE52,120:POKE56,120:POKE
    53280,15:POKE53281,12
94  13 PRINT
BF  14 PRINTSPC(8)CHR$(18)"[SU,S*
    22,SI]
26  15 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
B4  16 PRINTSPC(8)CHR$(18)"[S-,SP
    C4]DATA  STATEMENT[SPC3,S-]
3C  17 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
E5  18 PRINTSPC(8)CHR$(18)"[S-]
    TO MEMORY  ROUTINE  [S-]
4A  19 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
22  20 PRINTSPC(8)CHR$(18)"[S-,SP
    C5]BY LES ALLAN[SPC5,S-]
50  21 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
6C  22 PRINTSPC(8)CHR$(18)"[SJ,S*
    22,SK]
A0  23 PRINT:PRINTCHR$(155)
42  24 PRINT" THIS ROUTINE READS
    THE DATA STATEMENT,"
80  25 PRINT
17  26 PRINT" CONVERTS FROM  HEX
    TO BINARY AND POKES"
82  27 PRINT
C4  28 PRINT" CODE BACK  TO THE
    AREA OF MEMORY FROM"
84  29 PRINT
19  30 PRINT" WHICH  IT  WAS  PRE
    VIOUSLY  GENERATED."
59  31 PRINT:PRINT
D0  32 READCODE$
BB  33 LB=ASC(RIGHT$(CODE$,1))-48
    :IFLB>9THENLB=LB-7
CF  34 HB=ASC(LEFT$(CODE$,1))-48:
    IFHB>9THENHB=HB-7
32  35 PRINTSPC(5)CHR$(5)"READING
     MEMORY BLOCK ...";M1:PRINTCH
    R$(145);
28  36 POKEM1,HB*16+LB:M1=M1+1:CH
    =CH+HB+LB:IFM1<M2THEN32
DB  37 IFCH=28964THEN39
13  38 PRINT"CHECK SUM ERROR - CH
    ECK DATA STATEMENTS!":PRINTCH
    R$(19):END
EC  39 PRINT"  HIT RETURN TO SAVE
     COMPLETED PROGRAM"
D1  40 GETKEY$:IFKEY$<>CHR$(13)TH
    EN40
5C  41 SYS34567
10  42 :
CE  43 :::::::::::::::::: DATUM S
    TATEMENTS ::::::::::::::::
16  44 :
AD  45 DATA 00,08,08,00,00,9E,32,
```

```
   30,36,31,00,00,00,20,44,E5
6C 46 DATA A9,0C,8D,20,D0,8D,21,
   D0,EA,A9,36,85,01,4C,2B,0E
B7 47 DATA 01,A2,00,BD,E0,14,9D,
   00,08,E8,E0,70,D0,F5,20,44
AF 48 DATA E5,A9,0C,8D,20,D0,8D,
   21,D0,A9,00,85,FB,A9,08,85
C2 49 DATA FC,A0,01,B1,FB,49,AC,
   91,FB,AD,20,D0,49,03,8D,20
0C 50 DATA D0,C8,D0,EF,E6,FC,A5,
   FC,C9,D0,D0,E7,A9,00,8D,00
6A 51 DATA 08,A9,37,85,01,20,60,
   A6,20,8E,A6,4C,AE,A7,EE,EE
F8 52 DATA 47,4C,7C,FE,B3,4E,4E,
   3E,3C,21,29,3C,2F,23,4E,4E
7D 53 DATA 3D,2D,3C,2F,23,2C,22,
   2B,3C,4E,4E,B3,6E,DF,66,6B
0D 54 DATA 6E,F7,C8,56,47,4C,7C,
   FE,B3,4E,16,FD,B3,6E,BB,66
3A 55 DATA 68,6E,F7,C8,56,47,4C,
   7C,FE,B3,4E,16,FD,B3,6E,97
AA 56 DATA 66,69,6E,F7,C8,56,47,
   4C,7C,FE,B3,4E,04,FD,2C,37
7E 57 DATA 4E,03,FD,22,2B,3D,4E,
   2F,22,22,2F,20,4E,04,FD,B3
79 58 DATA 6E,73,67,66,6E,F7,C8,
   56,47,4C,7C,FE,B3,4E,16,FD
9F 59 DATA B3,6E,2F,67,67,6E,F7,
   C8,56,47,4C,7C,FE,A4,AE,16
8A 60 DATA FD,A5,6E,27,67,64,6E,
   F7,54,F7,6E,16,67,65,6E,F7
96 61 DATA 4C,F5,4E,4E,3A,27,3C,
   2B,2A,4E,21,28,4E,3E,2B,21
FA 62 DATA 3E,22,2B,4E,23,2F,25,
   27,20,29,4E,28,2F,22,3D,2B
55 63 DATA 4E,4E,2D,22,2F,27,23,
   3D,4C,6E,C9,67,62,6E,F7,4C
CB 64 DATA F5,4E,4E,21,20,4E,37,
   21,3B,3C,4E,3D,21,28,3A,39
2A 65 DATA 2F,3C,2B,4E,2B,36,3E,
   22,21,27,3A,3D,4E,4F,04,FD
06 66 DATA 4E,4E,39,2B,22,22,4C,
   6E,B8,67,63,6E,F7,4C,F5,4E
2F 67 DATA 4E,3A,26,27,3D,4E,4E,
   3E,3C,21,29,3C,2F,23,4E,3C
D9 68 DATA 21,3B,3A,27,20,2B,4E,
   3D,2D,3C,2F,23,2C,22,2B,3D
F7 69 DATA 4E,2D,21,2A,2B,4C,6E,
   68,64,60,6E,F7,4C,F5,4E,4E
53 70 DATA 3A,21,4E,4E,3E,3C,2B,
   38,2B,20,3A,4E,3A,2B,36,3A
03 71 DATA 4E,4E,28,3C,21,23,4E,
   2C,2B,27,20,29,4E,2D,26,2F
D0 72 DATA 20,29,2B,2A,4C,6E,65,
   64,61,6E,F7,6E,54,64,7E,6E
7F 73 DATA F7,4C,F5,4E,4E,3D,27,
   23,3E,22,37,4E,3A,3C,2F,20
39 74 DATA 3D,28,2B,3C,4E,3A,26,
   2B,4E,3E,3C,21,29,3C,2F,23
58 75 DATA 4E,3A,21,4E,2F,4E,20,
   2B,39,4C,6E,07,64,7F,6E,F7
BD 76 DATA 4C,F5,4E,4E,2A,27,3D,
   25,4E,3E,3C,27,21,3C,4E,3A
80 77 DATA 21,4E,3C,3B,20,20,27,
   20,29,4E,3A,26,27,3D,4E,4E
45 78 DATA 3E,3C,21,29,3C,2F,23,
   42,4C,6E,F6,64,7C,6E,F7,4C
09 79 DATA F5,4E,4E,2B,20,3A,2B,
   3C,4E,37,21,3B,3C,4E,3D,27
68 80 DATA 20,29,22,2B,4E,2D,26,
   2F,3C,2F,2D,3A,2B,3C,4E,2D
DD 81 DATA 21,2A,2B,4E,2F,20,2A,
   4C,6E,A9,64,7D,6E,F7,4C,F5
D7 82 DATA 4E,4E,2F,20,2A,4E,3A,
   26,2B,4E,3E,3C,21,3A,2B,2D
30 83 DATA 3A,27,21,20,4E,3C,21,
   3B,3A,27,20,2B,4E,22,21,2F
11 84 DATA 2A,3D,4E,2F,20,2A,4C,
   6E,98,64,7A,6E,F7,4C,F5,4E
0D 85 DATA 4E,3D,2F,38,2B,3D,4E,
   3A,26,2B,4E,20,2B,39,4E,2B
84 86 DATA 27,22,2B,4E,3A,26,3B,
   3D,54,4E,49,43,28,27,22,2B
2A 87 DATA 20,2F,23,2B,49,4C,6E,
   4B,65,7B,6E,F7,54,F7,54,F7
7E 88 DATA C8,5A,47,4C,6B,2B,20,
   3A,2B,3C,4E,3E,3C,21,3A,2B
4E 89 DATA 2D,3A,27,21,20,4E,2D,
   21,2A,2B,4E,2D,26,2F,3C,2F
75 90 DATA 2D,3A,2B,3C,4C,6E,59,
   65,78,6E,CF,25,4A,54,E5,25
05 91 DATA 4A,DC,4C,4C,C9,5C,5C,
   6E,2D,65,79,6E,2F,DC,A8,46
17 92 DATA 25,4A,47,6E,17,65,76,
   6E,F7,4C,FF,4E,07,FD,37,21
2C 93 DATA 3B,3C,4E,2D,21,2A,2B,
   4E,20,3B,23,2C,2B,3C,4E,27
DC 94 DATA 3D,4E,54,4E,08,FD,F3,
   07,FD,4C,55,2F,6E,E7,65,77
1C 95 DATA 6E,EF,3A,DC,5F,CA,5F,
   5B,5E,5E,54,EC,6E,D6,65,74
F7 96 DATA 6E,F7,4C,FF,4E,26,FD,
   4C,6E,A2,65,75,6E,F9,5A,5A
D6 97 DATA 5D,59,42,2F,54,F9,5B,
   5E,5A,56,42,2F,6E,B8,65,72
4C 98 DATA 6E,F0,5A,5E,57,58,6E,
   03.FD.25.EE.6E.6E.CE.6E,6E
20 99 DATA 2F,6E,E8,6E,04,FD,3A,
   6E,E5,55,CE,6E,6E,80,FF,FD
5D 100 DATA 80,FF,FD,80,FF,FD,80
   ,FF,FD,80,17,FD,CC,6E,D3,7E
F1 101 DATA 7F,F3,7E,6F,86,8E,1E
   ,BE,,9B,CC,6E,D3,52,7D,F3,52
7E 102 DATA 6D,86,8E,AA,BE,9B,22
   ,52,6D,80,33,FD,FF,FE,FE,4E
6F 103 DATA 2B,20,3A,2B,3C,4E,3E
   ,3C,21,29,3C,2F,23,4E,20,2F
80 104 DATA 23,2B,4E,51,4E,4E,7F
   ,0B,10,FD,FF,F3,10,FD,6B,6E
19 105 DATA 80,72,FD,2B,20,3A,2B
   ,3C,4E,3E,3C,21,29,3C,2F,23
8D 106 DATA 4E,20,2F,65,66,6E,6E
   ,F0,5C,5E,58,5F,6E,03,FD,CC
AC 107 DATA 6E,D3,73,66,F3,C9,6C
   ,86,8E,37,BE,9B,22,C9,6C,C7
89 108 DATA 58,EB,6F,CC,6E,D3,6E
   ,66,F3,6E,66,86,8E,1E,BE,9B
C1 109 DATA 4E,2A,8B,C7,62,E3,4E
   ,BE,E3,4F,BE,C7,6E,EB,95,C7
62 110 DATA 66,EB,92,CE,6F,DF,95
   ,27,4E,FF,95,C3,4E,BE,27,6D
D2 111 DATA E3,4E,BE,A6,BE,81,88
   ,92,CB,92,A7,BE,BE,89,C7,6E
9E 112 DATA E3,6E,66,C7,59,EB,6F
   ,4E,0E,C8,4E,E0,C8,22,C0,C9
6F 113 DATA 80,FF,FD,80,C0,FD,CC
   ,6E,E0,C9,6C,D3,3E,7E,9E,68
D4 114 DATA 4E,BC,91,86,BE,9B,4E
   ,8A,91,9E,95,A7,63,9E,77,A7
B6 115 DATA 7A,BE,68,A0,C9,6C,22
   ,06,7D,80,C9,6C,C0,C9,6C,F3
B0 116 DATA C6,6C,4E,BC,91,22,22
   ,6D,C7,66,C4,C6,4E,D4,91,C3
37 117 DATA C9,6C,CC,C7,CE,6C,4E
   ,D3,91,C7,6E,4E,BB,91,E8,95
57 118 DATA E0,5D,6F,EA,92,E2,5A
   ,6F,CE,6E,D7,6E,66,FF,95,A6
B0 119 DATA AE,1E,BE,98,CC,6E,D3
   ,7E,6F,F3,6F,66,86,8E,01,BE
32 120 DATA 9B,C7,58,EB,6F,C7,6E
   ,EB,95,C7,66,EB,92,CE,1E,DF
C0 121 DATA 95,27,4E,FF,95,A6,BE
   ,99,88,92,CB,92,A7,BE,BE,81
F1 122 DATA 80,C9,6C,C7,43,E3,C6
   ,6C,C3,C9,6C,CC,C6,CE,6C,4E
D7 123 DATA D3,91,C7,6F,EB,45,C7
   ,66,EB,42,76,C7,1E,03,5D,6F
B3 124 DATA C4,C7,6E,03,5A,6F,C6
   ,C7,45,4E,B6,91,22,0B,90,6E
BA 125 DATA 0C,FD,4F,66,6F,6E,F7
   ,A9,46,5F,5A,59,47,54,F9,5B
40 126 DATA 5D,5C,56,5E,42,5F,5B
   ,54,F9,5B,5D,5C,56,5F,42,5F
2C 127 DATA 5C,6E,2B,66,6C,6E,F7
   ,C8,56,47,4C,7C,FE,BB,AE,16
C4 128 DATA FD,A7,6E,07,66,6D,6E
   ,F7,C8,56,47,4C,7C,FE,B3,4E
CA 129 DATA 16,FD,B3,6E,E3,66,6A
   ,6E,F7,C8,56,EB,E0,E3,EB,EB
A2 130 DATA 75,D9,DB,DD,DA,EB,03
   ,FD,49,EB,56,F6,E3,76,4C,E9
4E 131 DATA 03,0B,B2,3B,1E,A7,4C
   ,E9,42,DD,6E,EA,49,EB,56,EB
A0 132 DATA FF,76,EB,E3,03,0B,9B
   ,3B,1E,CB,AF,0E,42,E7,66,CB
EB 133 DATA 3B,66,CA,3B,42,EB,6E
   ,10,42,E3,6E,17,4B,EA,5A,10
10 134 DATA A2,6E,7A,10,46,CB,3B
   ,A2,E8,66,CB,3B,23,3B,04,0D
CA 135 DATA 17,4E,17,22,3B,3B,0C
   ,42,EB,66,EB,E3,42,DC,6E,EA
83 136 DATA CB,8B,4D,CB,65,4D,A7
   ,45,4C,05,05,AC,A7,A4,AC,AC
EA 137 DATA 32,9E,9C,9A,9D,AC,03
   ,FD,0E,AC,11,B1,A4,31,0B,AE
21 138 DATA 44,4C,F5,7C,59,E0,0B
   ,AE,05,9A,29,AD,0E,AC,11,DC
9E 139 DATA B8,31,AC,A4,44,4C,DC
   ,7C,59,8C,E8,49,05,A0,21,8C
79 140 DATA 7C,21,8D,7C,05,AC,29
   ,57,05,A4,29,50,0C,AD,1D,57
1F 141 DATA E5,EB,3D,57,01,8C,7C
   ,E5,AF,21,8C,7C,64,7C,43,4A
F0 142 DATA 50,09,50,65,7C,7C,4B
   ,05,AC,21,AC,A4,05,9B;29,AD
75 143 DATA 8C,CC,0A,8C,22,0A,E0
   ,02,0B,42,42,A2,00,BD,6D,0E
F8 144 DATA 9D,10,01,E8,D0,F7,A2
   ,34,BD,D4,0E,9D,00,03,E8,D0
FC 145 DATA F7,EA,EA,A2,FF,9A,A9
   ,50,85,2D,38,E9,01,85,FE,A9
12 146 DATA 15,85,2E,E9,00,85,FF
   ,A9,2A,85,FC,A9,0E,85,FD,AD
A5 147 DATA 21,D0,85,FB,4C,52,01
   ,00,00,00,00,00,00,00,0B,08
5B 148 DATA 00,00,9E,32,30,36,31
   ,00,00,00,A2,00,BD,1D,08,9D
7E 149 DATA A7,02,E8,E0,59,D0,F5
   ,4C,A7,02,A9,36,85,48,C6,FC
26 150 DATA A5,FC,C9,FF,D0,02,C6
   ,FD,68,60,48,AD,20,D0,49,03
3D 151 DATA 8D,20,D0,C6,FE,A5,FE
   ,C9,FF,D0,02,C6,FF,68,60,A0
AA 152 DATA 00,B1,FC,C9,FD,D0,18
   ,EA,EA,EA,20,30,01,B1,FC,AA
86 153 DATA 20,30,01,B1,FC,91,FE
   ,20,3D,01,CA,D0,F8,F0,05,91
45 154 DATA FE,20,3D,01,A6,FC,CA
   ,86,FC,E0,FF,D0,02,C6,FD,A5
2F 155 DATA FE,C9,1F,A5,FF,E9,08
   ,B0,C8,A5,FB,8D,20,D0,A9,37
6B 156 DATA 85,01,20,60,A6,20,8E
   ,A6,A2,1F,BD,10,01,9D,00,08
D1 157 DATA CA,D0,F7,A9,FD,4C,34
   ,03,4C,AE,A7,EE,EE,EE,EE,EE
EA 158 DATA A9,00,85,FB,85,FD,A9
   ,80,85,FC,A9,08,85,FE,A0,00
E5 159 DATA B1,FB,91,FD,C8,D0,F9
   ,E6,FC,E6,FE,A5,FC,C9,A0,D0
10 160 DATA EF,A5,BA,AA,A8,20,BA
   ,FF,A9,0D,A2,55,A0,87,20,BD
AA 161 DATA FF,A9,01,85,2B,A9,08
   ,85,2C,A9,2B,A2,0B,A0,0F,20
FF 162 DATA D8,FF,4C,66,FE,50,52
   ,47,2E,53,43,52,41,4D,42,4C
1E 163 DATA 45,52,EE,EE,EE,EE,EE
   ,EE,EE,EE,EE,EE,EE,EE,EE,EE
9E 164 :
9F 165 :
26 166 ::::::::::::::::::::::::::::
   :::::::::::
E9 167 :  PROGRAM SCRAMBLER BY L
   ES ALLAN  :
CC 168 :
                  :
CE 169 :  28 ATKINSON DRIVE  NEW
   PORT  IW  :
2A 170 ::::::::::::::::::::::::::::
   :::::::::::
```

C16 Games

Specially for our C16/Plus/4 readers, we bring you a selection of the latest entertainment software for your computer.

By Paul Eves

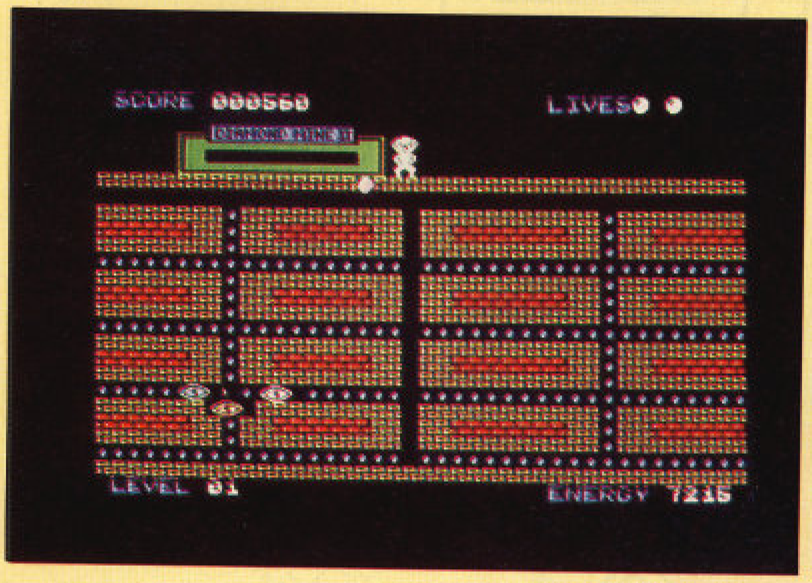
DIAMOND MINE

Diamond Mine is one of those games that is difficult to get to grips with at the start, but for some reason you have to keep having 'just one more go'.

The idea is to guide your pipe through the mine to reach the diamonds. You have to avoid contact with the walls and bugs, otherwise you lose that much pipe and you have to start all over again. On each level, the length of pipe you have to start with gets less and less, this is shown at the top left of the screen.

Movement of the pipe is one of those infuriating types of control. Once you start to move, you cannot stop. Therefore you not only have to be accurate, you must also have quick reflexes.

Although this looks a very simple game, there is quite a lot of hidden strategy involved in actual play. Pick the shortest route to a diamond, not the easiest, for example.



Although the graphics are simple, most of the screen is comprised of wall, I quite liked them. Overall, a difficult game to master but well worth the effort.

Touchline

Title: *Diamond Mine.* ***Company:*** *Blue Ribbon Software Ltd, CDS House, Beckett Road, Doncaster, South Yorks.* ***Price:*** *£1.99.*
Originality: *5/10.* ***Playability:*** *7/10.* ***Graphics:*** *7/10.* ***Value:*** *7/10.*

MAGICIANS CURSE

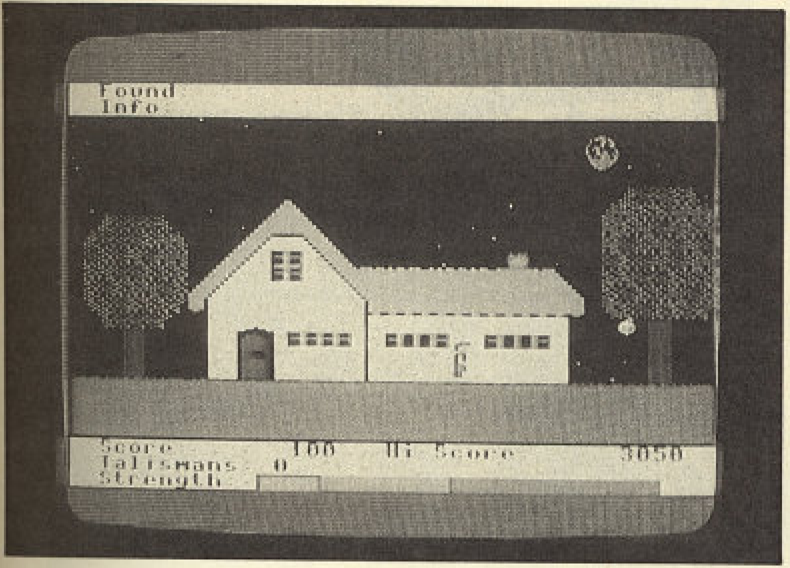
Gremlin Graphics has produced one of the better games for the C16/Plus/4 for some time, with Magicians Curse.

'Long ago, this land was inhabited by an evil magician. The land is now uninhabited etc.', so the inlay informs you. It's surprising how many evil magicians used to exist.

The prime object is to search this land of 48 screens and secure for yourself a golden statue. Before you achieve this goal however, you must also collect seven talismans. These can be found in various places just lying around.

Whilst you are busy running from screen to screen, your energy is quite understandably getting less and less. To counteract this, you need to either drink some potion, or eat some food. A couple of the locations will need a key to gain entry, whilst the underground caverns will need some light source to navigate.

Naturally, it is not quite this simple. There are the odd vampire bats lurking around, and falling apples to dodge. Be



careful which potions you eat, one of them is poisoned (find the antidote quick).

Considering the limitations in programming the C16, this is quite a good game. I especially liked the animation of the hero, no flicker to be seen anywhere. Also the stars twinkling in the night sky is pleasing. Well done Gremlin.

Touchline

Title: Magicians Curse. ***Company:*** *Gremlin Graphics, Alpha House 10 Carver Street, Sheffield, S1 4FS.* ***Price:*** *£6.95.*
Originality: *4/10.* ***Playability:*** *6/10.* ***Graphics:*** *7/10.* ***Value:*** *7/10.*

DIAMOND MINE II

Having completed Diamond Mine, you have now invested all your new found wealth into opening an even bigger mine. Diamond Mine II is virtually the as its predecessor except that there are a couple of variations.

In this version you have an assistant that keep your winch motor going. This time you can suck the nasties up into your pipe, however after a time they will re-appear, so watch out.

If you try to cross over your path, or go back the same way, a life is lost. You can however retract your pipe by pressing the return key. This feature of the game makes it a lot better to play than the original. You now have the ability to plan your tactics a lot better. After the 10th level the screens become 'invisible', making your taks that much harder.

Touchline

Title: Diamond Mine II. ***Company:*** *Blue Ribbon Software Ltd, CDS House, Beckett Road, Doncaster, South Yorks.* ***Price:*** *£1.99.*
Originality: *5/10.* ***Playability:*** *8/10.* ***Graphics:*** *7/10.* ***Value:*** *7/10.*

PINPOINT

For those of you that have seen Marble Madness, Pinpoint will hold no mystery. The concept is the same. You have to reach the white flag with your spinning top. Having achieved this, you go on to the next level.

Anco has here produced a game that should be very popular. I say should be, but I have my reservations. The main problem, is that the game is just too difficult to play and enjoy fully. Control of the top is via the joystick, and you need to be very precise in your movements.

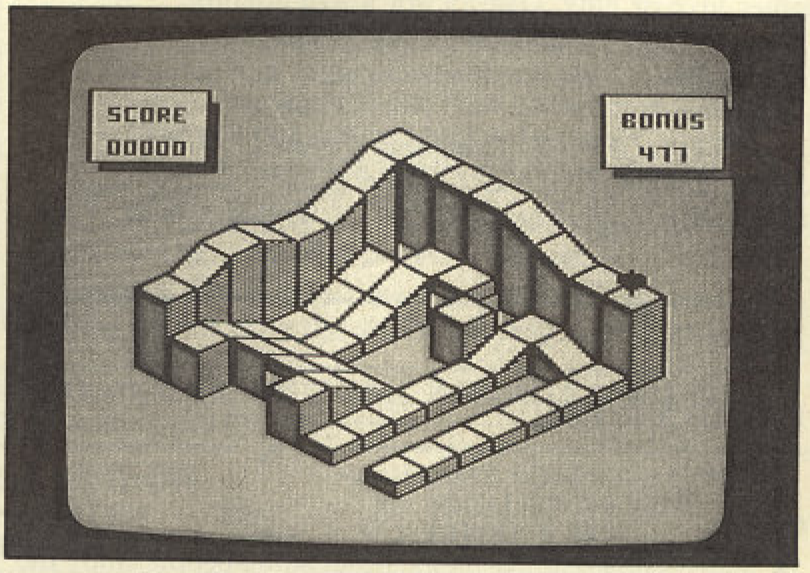
There are the usual steep slopes to climb, and chasms to leap. The downward slopes need to be tackled very slowly otherwise you lose your top off the edge. Understandably, sound is somewhat lacking, and I fear you will soon tire of the 'dit, dits' everytime you lose a top.

The inlay card informs you that there are 10 levels of difficulty, but I must confess to only reaching the fourth one before abondoning the play. The graphics are fairly good, being the two colour variety.

Lovers of Marble Madness and Spindizzy will obviously love this one, as for the rest of you, I have doubts.

Touchline

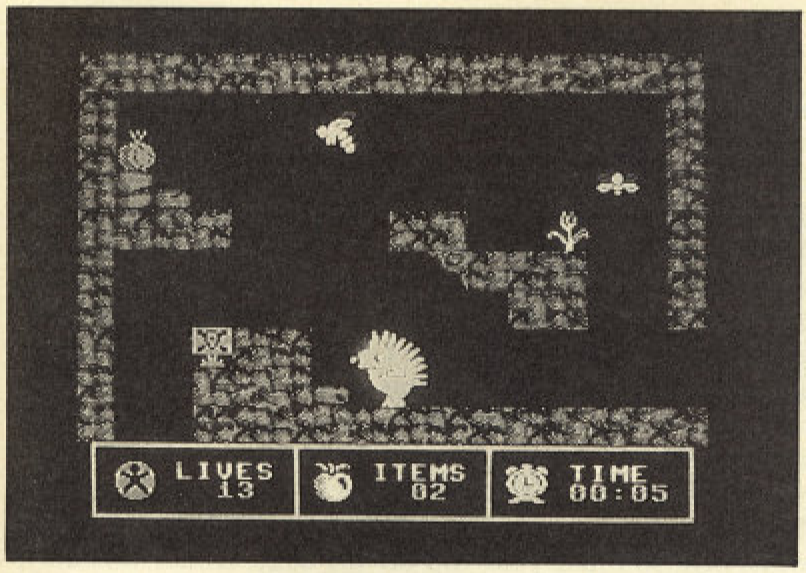
Title: Pinpoint. ***Supplier:*** *Anco Software, 4 Westgate House, Spital Street, Dartford, Kent.* ***Price:*** *£5.95.*
Originality: *5/10.* ***Playabililty:*** *4/10.* ***Graphics:*** *6/10.* ***Value:*** *6/10.*



SPIKY HAROLD

Firebird has come up with some real winners in the past, but I don't think that Spiky Harold will be one of them. It's a nice enough game, but I think it lacks that inexplainable quality of 'moreishness'.

The idea is that you have to help Harold collect as much grub as possible, to help him hibernate for the winter. The grub in question consists mainly of apples, grapes, pineapples, (What no nuts?) and wine. (Beware: not too much).



You have to visit various caverns to collect the said grub, each is filled with nasties of varying types. All the nasties have one thing in common, that is, they kill you on contact. This isn't too big a problem seeing as you start off with 19 lives.

The animation of the nasties is done very well. My only gripe is the 'Character Detect' routine. It takes some time before you can really judge safe distances.

In your wanderings you will, from time to time, come across a coin. Picking this up will give you one extra life. Just one point, the weatherman has predicted a severe frost in the next 24 hours. This would obviously kill our Harold, so you must succeed in your task before the time runs out.

Spiky Harold, is basically a platform game, which we either love or hate. Overall not a bad attempt.

Touchline

Title: Spiky Harold. ***Company:*** *Firebird, 74 New Oxford Street, London WC1A 1PS.* ***Price:*** *£.1.99.*
Originality: *4/10.* ***Playability:*** *5/10.* ***Graphics:*** *6/10.* ***Value:*** *7/10.*

DANGERZONE

There is no escaping the fact that some people enjoy the idea of blasting anything that moves. It must be an inbuilt desire that humans suffer from. Dangerzone lets you do just that.

As test pilot for the XT/99 Fighter come reconnaisance ship, you have to blast your way through 20 levels of asteroid belts. The higher the level, the faster they come at you. There are also the odd wave of alien craft to beat as well, so you need to keep your mind on your flying or else.

The scrolling is definitely smooth, and on the higher levels fast as well. My only real criticism, is that you can only move in one of two directions (up or down).

Your ship is equipped with rapid fire lasers. However constant use of this facility soon depletes your weaponary, so use this with caution.

Flying without firing will increase your fire-power but watch out. The action is fast and furious, but I feel that a couple of hours play is more than enough of this one.

Touchline

Title: *Dangerzone.* ***Company:*** *Codemasters, 1 Beaumont Business Centre, Beaumont Close, Banbury OX16 7RT.*
Originality: *3/10.* ***Playability:*** *6/10.* ***Graphics:*** *6/10.* ***Value:*** *5/10.*

ASTRO PLUMBER

You can be forgiven for thinking that you have seen this game before. The truth is, you have. I know this one better as Super Pipeline and Super Pipeline II by Tasket on the 64.

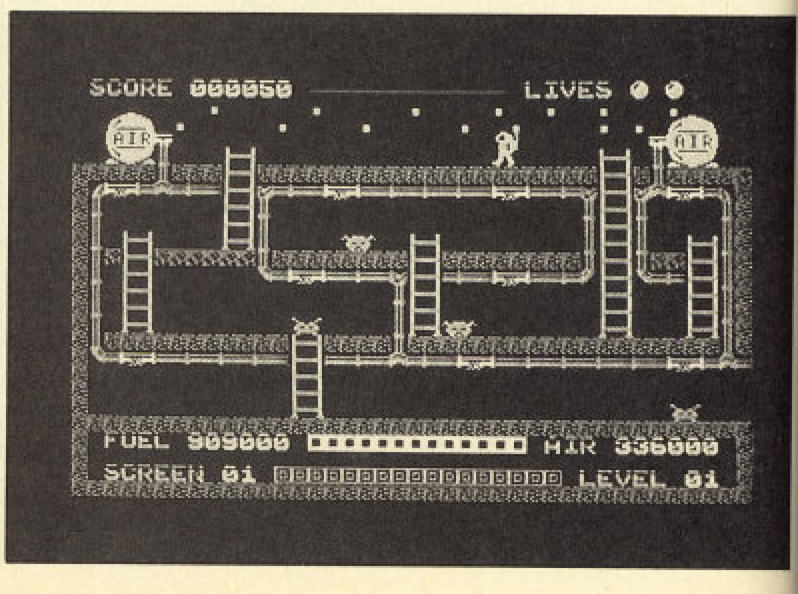
I am not putting this down though. It's a very good clone. You are the maintenance man just arrived from Earth. Your job is to repair the leaking air pipes that serve Colony II on the moon. (The underground caverns are inhabited by the usual nasties that have to be avoided. To aid you in this task you are wearing a jet pack, which I couldn't quite master.

You use your Plasma laser to repair the pipes. But excessive use drains your supply, so use with caution. You can leave a screen without completing all repairs, but when you return to that screen, the leaks have re-appeared.

You can use the air tanks on the surface of the moon to replenish your supply, but unfortunately you cannot use the jet pack whilst on the surface. When the pressure indicator for the level you are on shows full, you will be awarded a bonus score, and you then progress to the next round. YC

Touchline

Title: *Astro Plumber.* ***Company:*** *Blue Ribbon Software Ltd, CDS House, Beckett Road, Doncaster, South Yorks.* ***Price:*** *£1.99.*
Originality: *5/10.* ***Playability:*** *5/10.* ***Graphics:*** *7/10.* ***Value:*** *7/10.*



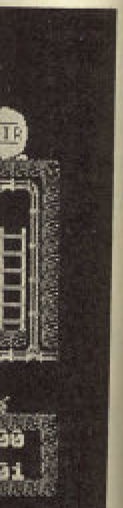
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Diskit 5

Disk users take heart. Here we provide a handy disk routine to convert memory to data statements.

By Les Allan

There are occasions when it is desirable to convert a section of memory from machine code to a Basic program containing a re-boot and set of data instructions that represent the original machine's memory.

This program provides the user with the facility to 'read' sections of machine memory to do just that! In fact the Basic loader for this program was produced from the very same routine.

Using the Program

Start and end addresses are entered to control the range of memory to be converted. These are POKEd into the machine code routine resident at $C000 which re-locates the Basic loader and performs the operation of 'reading' each byte to provide two digit hex number in the data statement e.g.

$8000 00 90 00 90 43 42 4D 80
10 DATA 00,90,00,43,42,4D,80

This process is repeated for every byte within the range as previously specified. The completed data listing is then saved to disk as DATA and should be re-loaded prior to running to establish start of variables which begin at the end of the Basic loader.

The SYS address contained in the Basic loader is the warm start address and should be modified to that required by the nature of the area of memory being converted.

The program must be typed in exactly as listed and saved prior to running. Error trap routines are included to ensure that the data as read is correct. The program, when run, stores the relevant code at a temporary address of $8000 and when prompted relocates the working program to Basic ($0801) and saves to the program to disk. YC

```
PROGRAM: MEMORY BOOT

3E  10 M1=32768:M2=36096:CH=0
97  11 PRINTCHR$(144)CHR$(147)
C8  12 POKE52,120:POKE56,120:POKE
    53280,15:POKE53281,12
94  13 PRINT
8F  14 PRINTSPC(8)CHR$(18)"[SU,S*
    22,SI]
26  15 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
B4  16 PRINTSPC(8)CHR$(18)"[S-,SP
    C4]DATA  STATEMENT[SPC3,S-]
3C  17 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
E5  18 PRINTSPC(8)CHR$(18)"[S-]
    TO MEMORY  ROUTINE  [S-]
4A  19 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
22  20 PRINTSPC(8)CHR$(18)"[S-,SP
    C5]BY LES ALLAN[SPC5,S-]
50  21 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
6C  22 PRINTSPC(8)CHR$(18)"[SJ,S*
    22,SK]
A0  23 PRINT:PRINTCHR$(155)
42  24 PRINT" THIS ROUTINE READS
    THE DATA STATEMENT,"
80  25 PRINT
17  26 PRINT" CONVERTS FROM  HEX
    TO BINARY AND POKES"
82  27 PRINT
C4  28 PRINT" CODE BACK  TO THE
    AREA OF MEMORY FROM"
84  29 PRINT
19  30 PRINT" WHICH  IT  WAS  PRE
    VIOUSLY  GENERATED."
59  31 PRINT:PRINT
D0  32 READCODE$
BB  33 LB=ASC(RIGHT$(CODE$,1))-48
    :IFLB>9THENLB=LB-7
CF  34 HB=ASC(LEFT$(CODE$,1))-48:
    IFHB>9THENHB=HB-7
32  35 PRINTSPC(5)CHR$(5)"READING
     MEMORY BLOCK ...";M1:PRINTCH
    R$(145);
28  36 POKEM1,HB*16+LB:M1=M1+1:CH
    =CH+HB+LB:IFM1<M2THEN32
DA  37 IFCH=43423THEN39
13  38 PRINT"CHECK SUM ERROR - CH
    ECK DATA STATEMENTS!":PRINTCH
    R$(19):END
EC  39 PRINT"  HIT RETURN TO SAVE
     COMPLETED PROGRAM"
D1  40 GETKEY$:IFKEY$<>CHR$(13)TH
    EN40
67  41 SYS35888
10  42 :
CE  43 :::::::::::::::::::: DATUM S
    TATEMENTS ::::::::::::::::
16  44 :
18  45 DATA 00,10,08,00,00,BB,41,
    B2,30,A7,9E,34,37,36,38,00
61  46 DATA 00,00,56,57,DC,16,E4,
    E6,67,F0,64,63,57,68,5F,55
80  47 DATA 57,C0,62,64,65,6F,67,
    78,66,62,6D,C0,62,64,65,6F
D2  48 DATA 66,78,66,65,6D,CE,90,
    7F,66,63,60,7E,6D,CE,57,3E
36  49 DATA 5F,54,57,CE,F1,62,7E,
    75,45,C7,82,97,97,97,97,97
A5  50 DATA 97,97,97,97,97,97,97,
    97,97,97,97,97,97,97,97,97
E0  51 DATA 97,97,97,97,97,97,97,
    9E,57,C5,5F,53,57,CE,F1,62
BB  52 DATA 7E,75,45,8A,77,77,77,
    77,77,77,77,77,77,77,77,77
9A  53 DATA 77,77,77,77,77,77,77,
    77,77,77,77,77,77,77,77,77
74  54 DATA 8A,57,EC,5F,52,57,CE,
    F1,62,7E,75,45,8A,77,1A,12
85  55 DATA 1A,18,05,0E,77,04,16,
    01,12,05,77,71,77,16,02,03
70  56 DATA 18,77,15,18,18,03,12,
    05,77,8A,57,B3,5F,51,57,CE
0F  57 DATA F1,62,7E,75,45,8A,77,
    77,77,77,77,77,77,77,77,77
9D  58 DATA 77,77,77,77,77,77,77,
    77,77,77,77,77,77,77,77,77
61  59 DATA 77,77,8A,57,5A,5E,50,
    57,CE,F1,62,7E,75,45,8A,77
E4  60 DATA 77,77,77,77,04,16,01,
    12,04,77,1A,12,1A,18,05,0E
83  61 DATA 77,11,05,18,1A,77,77,
    77,77,77,77,8A,57,61,5E,5F
90  62 DATA 57,CE,F1,62,7E,75,45,
    8A,77,77,77,77,77,77,77,77
E0  63 DATA 77,77,77,77,77,77,77,
    77,77,77,77,77,77,77,77,77
A2  64 DATA 77,77,77,77,8A,57,0B,
    5E,5E,57,CE,F1,62,7E,75,45
20  65 DATA 8A,77,73,67,6F,67,66,
    7A,73,14,11,11,11,77,77,77
5B  66 DATA 77,73,13,67,67,67,7A,
    73,11,11,11,11,77,8A,57,DF
98  67 DATA 5E,5D,57,CE,F1,62,7E,
    75,45,8A,77,77,77,77,77,77
EB  68 DATA 77,77,77,77,77,77,77,
    77,77,77,77,77,77,77,77,77
B7  69 DATA 77,77,77,77,77,77,8A,
    57,E6,5E,5C,57,CE,F1,62,7E
EF  70 DATA 75,45,8A,77,77,77,77,
    00,05,1E,03,03,12,19,77,15
E0  71 DATA 0E,77,18,12,04,77,16,
    18,18,16,19,77,77,77,77,8A
25  72 DATA 57,8D,5E,58,57,CE,F1,
    62,7E,75,45,8A,77,77,77,77
6E  73 DATA 77,77,77,77,77,77,77,
    77,77,77,77,77,77,77,77,77
09  74 DATA 77,77,77,77,77,77,77,
    77,8A,57,54,5D,5A,57,CE,F1
8F  75 DATA 62,7E,75,45,9D,94,94,
    94,94,94,94,94,94,94,94,94
83  76 DATA 94.94.94.94.94.94.94,
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     94,94,94,94,94,94,94,94,94
A0  77 DATA 94,9C,57,5C,5D,59,57,
    CE,6D,CE,57,6D,5D,58,57,CE
63  78 DATA 75,CC,77,77,03,1F,1E,
    04,77,05,18,02,03,1E,19,12
EB  79 DATA 77,00,1F,12,19,77,1B,
    18,16,13,12,13,77,1E,19,03
49  80 DATA 18,77,1A,12,1A,18,05,
    0E,75,57,3F,5D,47,57,CE,75
84  81 DATA 77,77,04,16,01,12,04,
    77,03,1F,12,77,00,18,05,1C
7F  82 DATA 1E,19,10,77,07,16,05,
    03,77,18,11,77,77,16,77,07
84  83 DATA 05,18,10,05,16,1A,75,
    57,C1,5D,46,57,CE,75,77,77
53  84 DATA 1E,19,77,03,00,18,77,
    07,16,05,03,04,79,77,03,1F
7E  85 DATA 12,77,14,1F,16,05,16,
    14,03,12,05,77,04,12,03,77
CC  86 DATA 77,16,19,13,75,57,93,
    5D,45,57,CE,75,77,77,03,1F
55  87 DATA 12,77,77,1C,12,05,19,
    16,1B,77,1E,04,77,77,05,12
B2  88 DATA 1B,18,14,16,03,12,13,
    77,77,03,18,77,77,73,66,67
05  89 DATA 67,67,75,57,9C,5D,44,
    57,CE,6D,57,AE,5D,43,57,CE
8C  90 DATA 75,77,77,16,77,77,15,
    18,18,03,77,05,18,02,03,1E
73  91 DATA 19,12,77,77,1E,04,77,
    16,1B,04,18,77,04,16,01,12
79  92 DATA 13,77,00,1F,1E,14,1F,
    75,57,70,5C,42,57,CE,75,77
1D  93 DATA 77,05,12,1B,18,14,16,
    03,12,04,77,03,1F,12,77,77
EB  94 DATA 14,1F,16,05,16,14,03,
    12,05,77,77,16,19,13,77,1C
5E  95 DATA 12,05,19,16,1B,75,57,
    02,5C,41,57,CE,75,77,77,16
31  96 DATA 19,13,77,03,1F,12,19,
    77,1B,18,16,13,04,77,71,77
46  97 DATA 77,05,02,19,04,77,03,
    1F,12,77,1A,16,1E,19,77,07
14  98 DATA 16,05,03,75,57,30,5C,
    40,57,DC,95,7F,66,6E,60,7E
DE  99 DATA E5,61,63,F0,65,64,57,
    2F,5C,4F,57,CE,75,C6,C6,C6
27  100 DATA C6,C6,C6,C6,C6,C6,75
    ,57,F1,5C,4E,57,CE,75,77,77
57  101 DATA 11,18,1B,1B,18,00,77
    ,77,03,1F,12,77,77,04,1E,1A
E1  102 DATA 07,1B,12,77,1E,19,04
    ,03,05,02,14,03,1E,18,19,04
F7  103 DATA 77,16,19,13,75,57,83
    ,5C,4D,57,CE,75,77,77,1E,03
FF  104 DATA 77,04,1F,18,02,1B,13
    ,77,15,12,77,07,18,04,04,1E
2D  105 DATA 15,1B,12,77,03,18,77
    ,14,18,19,01,12,05,03,77,16
A2  106 DATA 1B,1B,75,57,55,5B,4C
    ,57,CE,75,77,77,03,1F,18,04
F4  107 DATA 12,77,77,1A,02,1B,03
    ,1E,7A,07,16,05,03,77,77,07
96  108 DATA 05,18,10,05,16,1A,04
    ,77,1E,19,03,18,77,18,19,12
A0  109 DATA 75,57,67,5B,48,57,CE
    ,75,77,77,18,05,77,16,03,77
99  110 DATA 1A,18,04,03,77,03,00
    ,18,77,07,16,05,03,04,79,1E
6D  111 DATA 03,77,1E,04,77,19,12
    ,14,12,04,04,16,05,0E,75,57
08  112 DATA 09,5B,4A,57,CE,75,77
    ,77,1F,18,00,12,01,12,05,7B
D2  113 DATA 77,77,03,18,77,1C,19
    ,18,00,77,77,03,1F,12,77,04
BF  114 DATA 03,16,05,03,77,16,13
    ,13,05,12,04,04,75,57,DB,5B
F4  115 DATA 49,57,CE,75,77,77,18
    ,11,77,03,1F,12,77,07,05,18
4D  116 DATA 10,05,16,1A,77,00,1F
    ,1E,14,1F,77,14,16,19,77,15
A1  117 DATA 12,77,16,13,13,12,13
    ,77,03,18,75,57,ED,5B,48,57
D2  118 DATA CE,75,77,77,03,1F,12
    ,77,15,18,18,03,77,11,1E,1B
71  119 DATA 12,77,18,05,77,16,04
    ,77,16,77,1B,1E,19,12,77,19
F8  120 DATA 02,1A,15,12,05,77,03
    ,18,75,57,BF,5B,77,57,CE,75
68  121 DATA 77,77,03,1F,12,77,1A
    ,16,1E,19,77,11,1E,1B,12,77
A1  122 DATA 77,77,77,77,77,77,12
    ,79,10,79,77,66,67,77,04,0E
D2  123 DATA 04,77,65,67,61,66,75
    ,57,AD,5B,76,57,DC,95,7F,66
EE  124 DATA 6E,60,7E,E5,61,63,F0
    ,64,64,57,44,5A,75,57,DC,16
0D  125 DATA E5,67,F0,16,E5,66,6D
    ,C4,75,1A,12,1A,66,75,7B,6F
74  126 DATA 7B,66,57,7B,5A,74,57
    ,DC,16,E5,66,F0,16,E5,65,6D
1E  127 DATA C4,75,1A,12,1A,65,75
    ,7B,6F,7B,66,57,69,5A,73,57
CC  128 DATA DC,95,7F,66,6E,60,7E
    ,E5,61,63,F0,64,61,57,1D,5A
F1  129 DATA 72,57,CE,90,7F,66,63
    ,60,7E,57,21,5A,71,57,CE,75
C3  130 DATA 77,77,66,79,77,77,77
    ,1B,18,16,13,77,1E,19,77,07
E1  131 DATA 05,18,10,05,16,1A,77
    ,11,18,05,77,14,18,19,01,12
5E  132 DATA 05,04,1E,18,19,57,F2
    ,5A,70,57,CE,6D,CE,75,77,77
AD  133 DATA 65,79,77,77,77,07,05
    ,12,04,04,77,05,12,7A,04,12
CB  134 DATA 03,77,04,00,1E,03,14
    ,1F,77,1E,11,77,05,12,06,02
CA  135 DATA 1E,05,12,13,57,94,5A
    ,7F,57,CE,6D,CE,75,77,77,64
CA  136 DATA 79,77,77,77,1B,18,16
    ,13,70,1A,12,1A,66,70,7B,6F
08  137 DATA 7B,66,57,86,5A,7E,57
    ,CE,6D,CE,75,77,77,63,79,77
14  138 DATA 77,77,1B,18,16,13,70
    ,1A,12,1A,65,70,7B,6F,7B,66
7B  139 DATA 57,5A,59,7D,57,CE,6D
    ,CE,75,77,77,62,79,77,77,77
A9  140 DATA 04,0E,04,6F,65,6F,77
    ,03,18,77,04,16,01,12,77,07
4A  141 DATA 05,18,10,05,16,1A,77
    ,07,16,05,03,04,57,63,59,7C
E8  142 DATA 57,CE,6D,CE,75,77,77
    ,77,77,77,77,77,1A,16,1E,19
77  143 DATA 77,07,16,05,03,77,73
    ,67,6F,67,66,77,7A,77,73,14
FF  144 DATA 11,11,11,57,0C,59,7B
    ,57,CE,6D,CE,75,77,77,77,77
21  145 DATA 77,77,77,1C,12,05,19
    ,16,1B,77,77,77,77,73,13,67
08  146 DATA 67,67,77,7A,77,73,11
    ,11,11,11,57,D5,59,7A,57,CE
D1  147 DATA 6D,CE,75,77,77,77,77
    ,77,77,77,15,18,18,03,77,77
71  148 DATA 77,77,77,77,73,67,6F
    ,67,66,77,7A,77,73,64,11,11
1F  149 DATA 11,57,FB,59,79,57,CE
    ,6D,CE,75,77,77,61,79,77,77
28  150 DATA 77,14,05,02,19,14,1F
    ,77,14,18,13,12,77,03,18,77
67  151 DATA 04,16,01,12,77,1A,12
    ,1A,18,05,0E,57,89,59,78,57
87  152 DATA CE,6D,CE,6D,CE,75,77
    ,1C,12,05,19,16,1B,77,1E,04
6D  153 DATA 77,04,16,01,12,13,77
    ,15,12,03,00,12,12,19,77,77
1C  154 DATA 73,66,67,67,67,77,71
    ,77,73,64,11,11,11,57,58,58
C0  155 DATA 67,57,CE,6D,CE,75,15
    ,18,18,03,77,07,16,05,03,77
4B  156 DATA 05,12,1B,18,14,16,03
    ,12,04,77,1C,12,05,19,16,1B
03  157 DATA 77,16,02,03,18,1A,16
    ,03,1E,14,16,1B,1B,0E,57,76
3D  158 DATA 58,66,57,DC,95,7F,66
    ,6E,60,7E,E5,61,63,F0,63,6E
D8  159 DATA 57,7B,58,65,57,C9,61
    ,62,66,65,61,57,65,58,64,57
D8  160 DATA 6D,57,0C,58,63,57,6D
    ,6D,6D,6D,6D,6D,6D,6D,6D,6D
96  161 DATA 6D,6D,6D,6D,6D,6D,6D
    ,6D,6D,6D,6D,6D,6D,6D,6D,6D
C1  162 DATA 6D,6D,6D,6D,6D,6D,6D
    ,6D,6D,6D,57,D3,58,62,57,6D
D4  163 DATA 6D,6D,6D,6D,6D,6D,6D
    ,6D,6D,6D,6D,6D,6D,6D,6D,6D
1B  164 DATA 6D,6D,6D,6D,6D,6D,6D
    ,6D,6D,6D,6D,6D,6D,6D,6D,6D
FF  165 DATA 6D,6D,6D,57,FA,58,61
    ,57,6D,6D,77,77,77,77,77,77
89  166 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
E6  167 DATA 77,77,77,77,77,77,77
    ,77,77,77,6D,6D,57,83,58,60
BC  168 DATA 57,6D,6D,77,77,77,D8
    ,12,1A,15,12,05,77,00,1F,12
62  169 DATA 19,77,0E,18,02,77,03
    ,16,1C,12,77,03,1F,12,77,77
BE  170 DATA 77,6D,6D,57,AA,58,6F
    ,57,6D,6D,77,77,77,77,77,77
CC  171 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
57  172 DATA 77,77,77,77,77,77,77
    ,77,77,77,6D,6D,57,73,47,6E
F9  173 DATA 57,6D,6D,77,77,77,14
    ,05,12,13,1E,03,77,D6,77,03
79  174 DATA 1F,1E,04,77,77,07,05
    ,18,10,05,16,1A,1A,12,77,77
F5  175 DATA 77,6D,6D,57,1A,47,6D
    ,57,6D,6D,77,77,77,77,77,77
D7  176 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
87  177 DATA 77,77,77,77,77,77,77
    ,77,77,77,6D,6D,57,21,47,6C
CF  178 DATA 57,6D,6D,77,77,77,03
    ,1F,16,03,77,1A,16,19,0E,77
95  179 DATA 1F,18,02,05,04,77,00
    ,12,05,12,77,04,07,12,19,03
D1  180 DATA 77,77,77,6D,6D,57,C8
    ,47,6B,57,6D,6D,77,77,77,77
1A  181 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
48  182 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,6D,6D,57,94
5D  183 DATA 47,6A,57,6D,6D,77,77
    ,77,15,0E,77,03,1F,12,77,16
56  184 DATA 02,03,1F,E7,77,F3,77
    ,C3,77,77,0E,18,02,77,77,77
80  185 DATA 6D,6D,57,BB,47,69,57
    ,6D,6D,77,77,77,77,77,77,77
1D  186 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
FA  187 DATA 77,77,77,77,77,77,77
    ,77,77,6D,6D,57,44,46,68,57
C8  188 DATA 6D,6D,77,77,77,03,1E
    ,1A,12,77,04,18,77,14,18,1A
64  189 DATA 12,77,C6,77,15,12,77
    ,16,77,04,07,E7,03,77,77,77
33  190 DATA 6D,6D,57,6B,46,17,57
    ,6D,6D,77,77,77,77,77,77,77
60  191 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
03  192 DATA 77,77,77,77,77,77,77
    ,77,77,6D,6D,57,36,46,16,57
06  193 DATA 6D,6D,77,77,77,F8,77
    ,10,1E,01,12,77,77,03,1F,12
40  194 DATA 77,77,1F,C6,18,02,05
    ,04,77,77,F3,77,77,77,6D,6D
BA  195 DATA 57,DD,46,15,57,6D,6D
    ,77,77,77,77,77,77,77,77,77
6B  196 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
69  197 DATA 77,77,77,77,77,77,77
    ,6D,6D,57,E5,46,14,57,6D,6D
21  198 DATA 77,77,77,03,1F,12,77
    ,16,02,03,1F,E7,77,77,77,77
7C  199 DATA 77,77,77,1B,12,04,77
    ,16,1B,1B,16,19,77,77,77,6D
20  200 DATA 6D,57,BC,46,13,57,6D
    ,6D,77,77,77,77,77,77,77,77
EE  201 DATA 77,77,77,77,77,77,77
    ,77,77,77,77,77,77,77,77,77
E9  202 DATA 77,77,77,77,77,77,77
    ,77,6D,6D,57,55,45,12,57,6D
40  203 DATA 6D,77,77,77,65,6F,77
    ,16,03,1C,1E,19,04,C6,77,13
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A7  204 DATA 05,1E,01,12,77,77,77
    ,19,70,07,E7,03,77,77,77,6D
A5  205 DATA 3A,00,2B,12,46,00,3A
    ,3A,20,20,20,20,20,20,20,20
41  206 DATA 20,20,20,20,20,20,20
    ,20,20,20,20,20,20,20,20,20
47  207 DATA 20,20,20,20,20,20,20
    ,20,3A,3A,00,54,12,47,00,3A
47  208 DATA 3A,3A,3A,3A,3A,3A,3A
    ,3A,3A,3A,3A,3A,3A,3A,3A,3A
26  209 DATA 3A,3A,3A,3A,3A,3A,3A
    ,3A,3A,3A,3A,3A,3A,3A,3A,3A
DD  210 DATA 3A,3A,3A,00,7D,12,48
    ,00,3A,3A,3A,3A,3A,3A,3A,3A
A4  211 DATA 3A,3A,3A,3A,3A,3A,3A
    ,3A,3A,3A,3A,3A,3A,3A,3A,3A
AB  212 DATA 3A,3A,3A,3A,3A,3A,3A
    ,3A,3A,3A,3A,3A,00,00,00,00
60  213 DATA 41,00,81,00,00,00,00
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
B9  214 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
85  215 DATA A9,1D,8D,10,08,A9,08
    ,8D,11,08,A9,00,85,FB,A9,08
0F  216 DATA 85,FC,A0,12,B1,FB,49
    ,57,91,FB,C8,D0,F7,E6,FC,A5
3F  217 DATA FC,C9,12,D0,EF,60,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
3D  218 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
7C  219 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
83  220 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
21  221 DATA A2,00,BD,0D,08,9D,A7
    ,02,E8,E0,59,D0,F5,4C,B7,02
7F  222 DATA 78,A9,34,85,01,A0,00
    ,84,FB,84,FD,A9,10,85,FC,A9
F6  223 DATA D0,85,FE,B1,FB,91,FD
    ,C8,D0,F9,E6,FC,E6,FE,D0,F3
B2  224 DATA A9,37,85,01,58,A9,0
    ,AA,A8,20,BA,FF,A9,04,A2,FA
43  225 DATA A0,02,20,BD,FF,A9,0
    ,20,D5,FF,20,60,A6,20,8E,A6
71  226 DATA 4C,AE,A7,4D,41,49,4
    ,00,00,EE,EE,EE,EE,EE,EE,EE
7E  227 DATA A9,36,85,01,A9,01,8
    ,2B,A9,08,85,2C,A9,E9,8D,FE
A5  228 DATA 03,A9,D0,8D,FF,03,2
    ,CE,03,78,A9,34,85,01,A0,00
2F  229 DATA 84,2B,84,FB,84,FD,A
    ,10,85,2C,85,FC,A9,D0,85,FE
46  230 DATA B1,FD,91,FB,C8,D0,F
    ,E6,FC,E6,FE,D0,F3,A9,37,85
7D  231 DATA 01,58,A9,ED,8D,FE,0
    ,A9,40,8D,FF,03,20,CE,03,A9
14  232 DATA 00,A8,84,FB,A2,08,B
    ,FC,91,FB,C8,D0,FB,E6,FC,A6
7E  233 DATA FC,E0,10,D0,F3,A2,0
    ,BD,F5,03,9D,01,08,E8,E0,09
53  234 DATA D0,F5,A2,00,BD,A7,0
    ,9D,0D,08,E8,E0,59,D0,F5,A9
F3  235 DATA 01,85,2B,A9,08,85,2
    ,A9,F1,8D,FE,03,20,CE,03,4C
72  236 DATA 66,FE,A9,08,AA,A8,2
    ,BA,FF,A9,04,AE,FE,03,A0,03
B3  237 DATA 20,BD,FF,A9,2B,A2,0
    ,AC,FF,03,4C,D8,FF,4D,41,49
24  238 DATA 4E,4B,45,52,4E,42,4
    ,4F,54,0B,08,00,00,9E,32,30
69  239 DATA 36,31,00,00,EE,EE,E
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
8C  240 DATA A0,00,A8,85,FB,85,F
    ,A9,80,85,FC,A9,08,85,FE,B1
BF  241 DATA FB,91,FD,C8,D0,F9,E
    ,FC,E6,FE,A5,FC,C9,A0,D0,EF
DB  242 DATA A2,00,BD,00,8B,9D,A
    ,02,E8,E0,59,D0,F5,A2,00,BD
76  243 DATA 60,8B,9D,3C,03,E8,E
    ,C4,D0,F5,A9,08,AA,A8,20,BA
77  244 DATA FF,A9,0C,A2,D0,A0,8
    ,20,BD,FF,A9,01,85,2B,A9,08
CA  245 DATA 85,2C,A9,2B,A2,D0,A
    ,12,20,D8,FF,A9,04,A2,E0,A0
FA  246 DATA 8C,20,BD,FF,A9,A7,8
    ,2B,A9,02,85,2C,A9,2B,A2,00
1C  247 DATA A0,03,20,D8,FF,A9,0
    ,A2,E8,A0,8C,20,BD,FF,A9,3C
38  248 DATA 85,2B,A9,03,85,2C,A
    ,2B,A2,00,A0,04,20,D8,FF,4C
1F  249 DATA 66,FE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
01  250 DATA 4D,45,4D,4F,52,59,20
    ,53,41,56,45,52,EE,EE,EE,EE
29  251 DATA 4D,45,4D,31,EE,EE,EE
    ,EE,4D,45,4D,32,EE,EE,EE,EE
23  252 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
C7  253 :
C4  254 :
FF  255 :::::::::::::::::::::::::::
    :::::::::::
A4  256 :  MEMORY SAVER     BY LE
    S ALLAN   :
0D  257 :  28 ATKINSON DRIVE  NEW
    PORT IW   :
83  258 :::::::::::::::::::::::::::
    :::::::::::
```

Split Sprite

Many programmers find that sprite manipulation can be hard work. Perhaps this program will make things a little easier.

By S.J. Chance

While developing a machine code program recently, after the initial paperwork I thought it might be constructive to do a 'rough sketch' of it in Basic. Slow it might be, but it's a good way to flush out a few errors in logic and structure, which might otherwise only be uncovered after hours wasted producing redundant code.

I immediately ran into a problem. I intended to use more than eight hardware sprites in the program, and of course it is quite impossible to write a raster-interrupt routine in Basic. For the sake of thoroughness, I shall explain the nature of raster interrupts for the uninitiated.

The image on your monitor screen is drawn by an electron beam scanning across the screen in a series of horizontal lines, each line starting just below the previous one. This pattern of lines is called a raster.

Now as we all know, the VIC chip in a 64 supports eight hardware sprites. However, if you put your sprites at the top of the screen, and then use a raster interrupt to find out when the raster has travelled far enough down the screen to have drawn these sprites, you can then reposition them further down the screen so that when the raster gets to their new location, it draws them all over again. And when you reposition the sprites you can also change their colour and definition.

I decided to write a routine which would make raster-interrupt sprites available from Basic. This was quite easy to do, but created a new problem. I had settled on a screen format of five zones, (see Fig.1) which meant that my routine was being called 250 times per second. With all that going on, Basic was running at about 1/4 of its normal speed. With potentially 40 sprites to manipulate in addition to whatever else it was doing, it became clear that Basic would need helping out.

I extended Basic with a set of extra commands to set sprite parameters and move them around. Although this slowed down the interpreter even more, the new commands were more efficient and therefore resulted in a net increase in speed. These commands are listed in Figure 2, and I will say more about them later.

Returning to Figure 1, you will see that it shows the screen divided into zones 0 to 4, and link spaces 0 to 3. The zones are the areas in which the top edge of an unexpanded sprite can be positioned such that the sprite is clear of the raster-interrupt divisions above and below it.

If a sprite is positioned in link space, part of it will lie across the raster-interrupt line and will be drawn with the sprite parameters for the adjacent zone. To prevent the sprite from looking as if it has been torn in half, it must be 'linked' to the equivalent sprite in the next zone, i.e. that sprite must share the same parameters. If that all seems a bit of a headache, it will become clearer later on

Understanding the Commands

Looking again at Figure 2, all the commands are prefixed by the £ symbol. This is not intended as a source of inspiration, but rather to divert handling of the commands away from the normal interpreter. You will see that many of the commands use the syntax

[zone],[sprite]

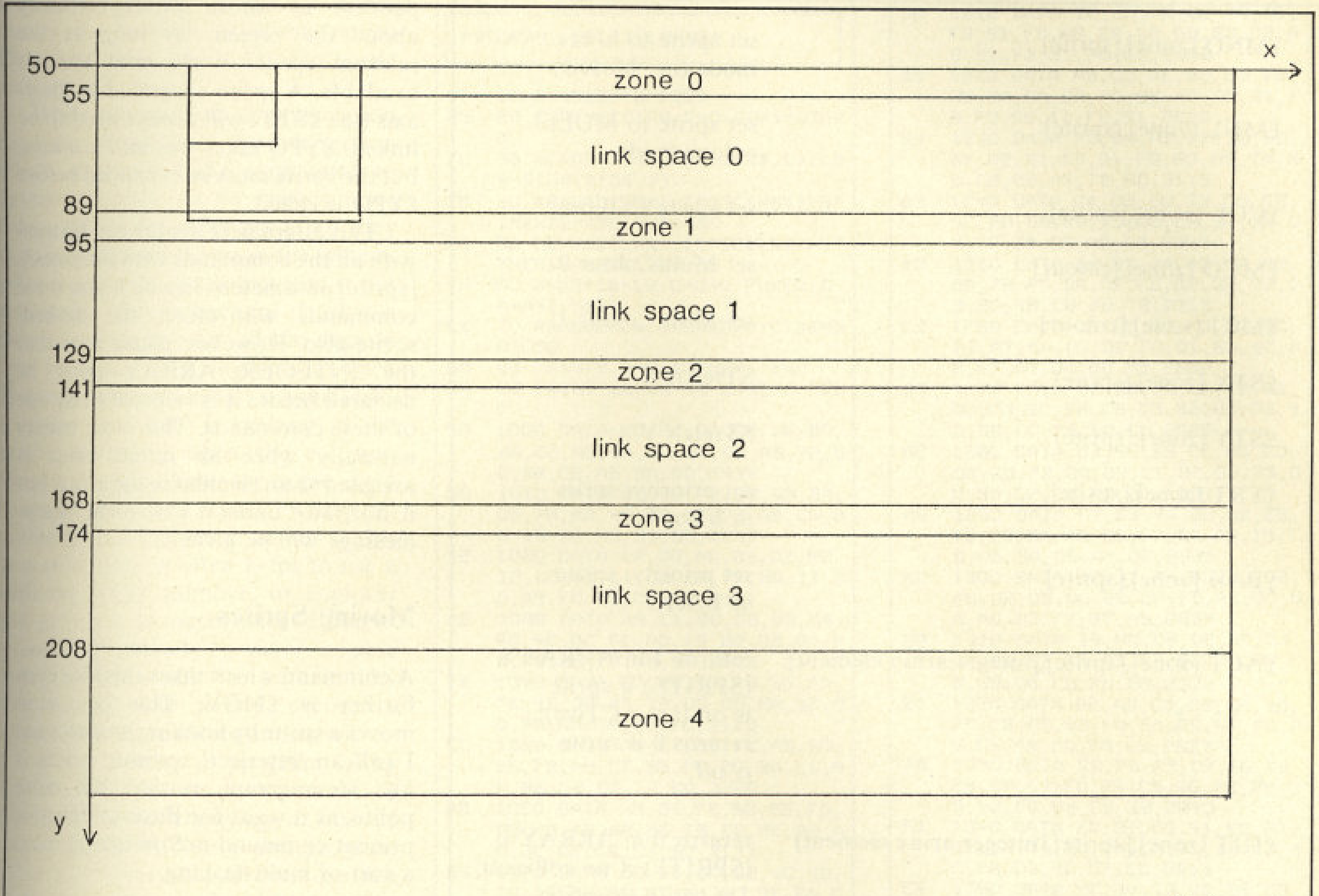


fig 1

where zone=0 to 4 and sprite=0 to 7. From now on I shall refer to a specific sprite by these parameters e.g. sprite 3,6 is sprite number 6 in zone 3.

Having said that, the Basic extension supports a far easier way of specifying a sprite. Consider the command £YPO in Figure 2. When positioning a sprite with this command, it is important that the y co-ordinate falls within the specified zone. This is easy enough to do using Figure 1, but there is an alternative syntax. This is to assign an integer array element to the sprite, replacing [zone], [sprite] in the syntax. For instance, suppose I give the command

£YPO 2,6,130

positioning sprite 6 in zone 2 at y=130. This is correct as y=130 falls within zone 2. However, if I give the command

£YPO C%(6),130

the sprite will be positioned exactly as before, and the correct zone number will be written into C%(6). i.e. C%(6) will now equal 2.

£YPO C%(6),150

will move the sprite into link space 2, so it will automatically by 'linked' to sprite 3,6 i.e. its parameters will be copied into sprite 3,6 . C%(6) will still equal 2.

£YPO C%(6),170

moves sprite C%(6) into zone 3. Sprite 2,6 will automatically be disabled, and the value of C%(6) will change to 3.

Using this system, it is quite

Figure 2

£VIS [zone],[sprite]	enable sprite (i.e. make sprite VISible.
£OFF [zone],[sprite]	disable sprite.
£XPO [zone],[sprite],[x co-ordinate]	set X Position.
£YPO [zone],[sprite],[y co-ordinate]	set Y Position.
£FRM [zone],[sprite],[definition no.]	set pointer to sprite definition (i.e. FRaMe)

£MNO [zone],[sprite]	set sprite to hi-res mode (i.e. MoNO).
£MUL [zone],[sprite]	set sprite to MULti-colour mode.
£COL [zone],[sprite]	set sprite COLour.
£MCO [zone],[colour]	set MultiColour 0.
£MC1 [zone],[colour]	set MultiColour 1.
£STX [zone],[sprite]	STretch X.
£STY [zone],[sprite]	STretch Y.
£FRT [zone],[sprite]	set priority: sprite in FRonT.
£BAK [zone],[sprite]	set priority: sprite at BAcK.
£ACT [zone],[sprite],[integer array element]	returns 1 in ARRAY% (SPRITE) if sprite is on (i.e. ACTive); returns 0 if sprite is off.
£HIT [zone],[sprite],[integer array element]	returns 0 in ARRAY% (SPRITE) if no collision; 1 if sprite to sprite; 2 if sprite to data; 3 if both.
£MOV [sprite integer array],[x offset], [y offset],[number of moves],[x integer array], [y integer array]	MOVes sprite through (x,y) for set number of moves, storing the new co-ordinates in XARRAY%(SPRITE), YARRAY%(SPRITE).
£P [pace]	sets the Pace of BASIC relative to the movement of sprites, from 0 to 200. 0: BASIC slow/sprites fast 200: BASIC fast(ish)/ sprites slow
£R	stops all sprites being MOVed, and clears LINK table, (i.e. Resets).
£Q	Quits split sprite.
SYS 49152	cold start.
SYS 49155	warm start.

painless to move sprites vertically about the screen, as long as the relevant sprite in the next zone is available. A sprite expanded in the y-axis (see £STY) will always need to be linked. £YPO takes this into account, but the sprite must be expanded before £YPO is called.

This alternative syntax can be used with all the commands with the [zone], [sprite] parameters, in which case these commands will affect the 'linked' sprite also. However, please note that the INTEGER ARRAY must be declared before it is referred to by one of these commands. This often occurs naturally when an initial value is assigned to an element in the array, but if not, an "undef'd statement" error message will be given.

Moving Sprites

A command which takes this idea even further is £MOV. This command moves a sprite by hooking it on to what I call an 'interject' routine, which is like an interrupt routine, but more polite, as it waits for Basic to finish its present command before taking over; a sort of multi-tasking.

£MOV C%(7),-2,4,10,CX%(7),CY%(7)

will move sprite C%(7) from (x,y) to (x-2,y+4) 10 times, each time storing the new co-ordinates in CX%(7),CY% (7). The frequency of these moves against the speed of Basic is controlled by the £P [pace] command where pace can have any value between zero and 200. Again, the relevant arrays must be declared before the command is used. Up to 20 sprites may be £MOVed at any one time.

Other commands which pass values to an array are £ACT and £HIT.

The Demo

Listed with the SPLIT SPRITE LOADER is a demonstration program using many of the new commands. It is probably most constructive to RUN this while following the listing, which I have tried to make as clear as possible. The program waits between the main sections so you can work out what is going on.

Before loading the demo program, make sure you have run the one line

DEMO SET-UP program, which moves the bottom of Basic up to $0A00 to make room for the sprite definitions.

When running the demonstration program, please note the last section which uses the £HIT command to detect collisions. As the sprites move back and forth, every so often they demonstrate a weakness in the system, when a perfectly good collision is not registered. This is because it takes a finite time to transfer all the data to and from the VIC registers at each interrupt, and as a result it sometimes happens that VIC is looking in the wrong direction when the collision occurs. In fact there are some dead spots in mid 'link space' where no collisions are registered at all. If this proves critical, it often helps to use a different sprite number, or engineer the collision to occur at a different point. Alternatively, a more reliable system is to check for collision by comparing the array elements containing the sprite co-ordinates.

When writing a program using SPLIT SPRITE, it is important to remember that changing a line of Basic, or re-RUNning the program clears all the variables. If there is still a sprite hooked onto the MOV routine, when you next enter any Basic command, the MOV routine will be called and will be unable to locate the relevant arrays. This will give an error message, which does not really matter, but the way to avoid it is to execute £R beforehand.

SPLIT SPRITE itself is presented here as a Basic Loader. When POKEd into memory, the program resides at $C000 — $CD07. Life will obviously move faster if, once loaded, you save this block of memory for future use, with a machine code monitor.

The program uses the rest of the $C-block along with $02B6 — $02DD to store variables, and is initialised by SYS 49152.

A final thought: if you do write a masterpiece with SPLIT SPRITE and intend to save it to tape, make sure you £Quit the program first to avoid timing problems, as I would hate to be responsible for the kind of grief I experienced when, while writing SPLIT SPRITE and preparing to make a back-up copy of my work so far, I accidentally re-formatted the only disk I had it on. Augh! YC

PROGRAM: SPLIT LOADER

```
09   10 A=49152:B=1000
24   20 FORZ=0TO158:C=0:FORY=0TO2
     0
72   30 READD$:HB$=LEFT$(D$,1):LB
     $=RIGHT$(D$,1)
78   40 HB=VAL(HB$):IFASC(HB$)>57
     THENHB=ASC(HB$)-55
86   50 LB=VAL(LB$):IFASC(LB$)>57
     THENLB=ASC(LB$)-55
4A   60 D=HB*16+LB:C=C+D:POKEA,D:
     A=A+1:NEXT
EE   70 READCHECK:IFCHECK<>CTHENG
     OTO90
60   80 PRINTB:B=B+10:NEXT:END
7A   90 PRINT"ERROR IN LINE"B:STO
     P
98   1000 DATA 20,27,CA,A9,18,8D,
     B6,02,A9,4A,8D,B7,02,A9,72,8
     D,B8,02,A9,9A,8D,2434
90   1010 DATA B9,02,A9,C2,8D,BA,
     02,78,A9,49,8D,14,03,A9,C0,8
     D,15,03,A9,01,8D,2242
42   1020 DATA 1A,D0,AD,B6,02,8D,
     12,D0,AD,11,D0,29,7F,8D,11,D
     0,A9,F0,8D,08,03,2451
AE   1030 DATA A9,C1,8D,09,03,58,
     60,4C,BC,FE,AD,19,D0,29,01,F
     0,F6,A5,FB,48,A5,2804
7E   1040 DATA FC,48,A5,FD,48,A5,
     FE,48,38,AD,12,D0,CD,BA,02,9
     0,3D,A9,C8,85,FD,3113
CC   1050 DATA A9,CE,85,FE,A9,90,
     85,FB,A9,CE,85,FC,20,3A,C1,A
     D,B6,02,8D,12,D0,3226
AB   1060 DATA 68,85,FE,68,85,FD,
     68,85,FC,68,85,FB,EE,BE,02,A
     D,BE,02,C9,03,B0,3133
55   1070 DATA 06,EE,DA,02,4C,46,
     C0,A9,00,8D,BE,02,4C,31,EA,C
     D,B9,02,90,1C,A9,2396
69   1080 DATA 90,85,FD,A9,CE,85,
     FE,A9,58,85,FB,A9,CE,85,FC,2
     0,3A,C1,AD,BA,02,3337
D8   1090 DATA 8D,12,D0,4C,26,C1,
     CD,B8,02,90,1C,A9,58,85,FD,A
     9,CE,85,FE,A9,20,2843
5A   1100 DATA 85,FB,A9,CE,85,FC,
     20,3A,C1,AD,B9,02,8D,12,D0,4
     C,26,C1,CD,B7,02,2851
CE   1110 DATA 90,1C,A9,20,85,FD,
     A9,CE,85,FE,A9,E8,85,FB,A9,C
     D,85,FC,20,3A,C1,3348
A4   1120 DATA AD,B8,02,8D,12,D0,
     4C,26,C1,CD,B6,02,90,1C,A9,E
     8,85,FD,A9,CD,85,2888
1D   1130 DATA FE,A9,C8,85,FB,A9,
     CE,85,FC,20,3A,C1,AD,B7,02,8
     D,12,D0,4C,26,C1,3082
E0   1140 DATA A9,01,8D,19,D0,68,
     85,FE,68,85,FD,68,85,FC,68,8
     5,FB,4C,BC,FE,A0,3180
AD   1150 DATA 00,B1,FD,99,00,D0,
     C8,C0,11,D0,F6,A0,15,B1,FD,9
     9,00,D0,A0,17,B1,2986
7C   1160 DATA FD,99,00,D0,A0,1B,
     B1,FD,99,00,D0,C8,C0,1E,D0,F
     6,A0,25,B1,FD,99,3248
9A   1170 DATA 00,D0,C8,C0,2F,D0,
     F6,A2,00,B1,FD,9D,F8,07,E8,C
     8,C0,37,D0,F5,A0,3397
4F   1180 DATA 1E,B9,00,D0,11,FB,
     91,FB,C8,B9,00,D0,11,FB,91,F
     B,60,AD,BD,02,0A,2814
87   1190 DATA A8,B1,FB,91,FD,C8,
     B1,FB,91,FD,A0,10,20,CE,C1,A
     0,15,20,CE,C1,A0,3399
B4   1200 DATA 17,20,CE,C1,A0,1B,
     20,CE,C1,A0,1C,20,CE,C1,A0,1
     D,20,CE,C1,A9,27,2519
3A   1210 DATA 18,6D,BD,02,A8,B1,
     FB,91,FD,A9,2F,18,6D,BD,02,A
     8,B1,FB,91,FD,60,2948
B0   1220 DATA A9,00,AE,BD,02,E8,
     38,2A,CA,D0,FC,8D,BF,02,31,F
     B,F0,05,11,FD,91,2820
64   1230 DATA FD,60,A9,FF,38,ED,
     BF,02,31,FD,91,FD,60,A5,7A,8
     D,C9,02,A5,7B,8D,3115
23   1240 DATA CA,02,20,73,00,C9,
     5C,D0,0A,20,73,00,C9,52,D0,0
     3,4C,BB,CC,AD,C9,2344
B9   1250 DATA 02,85,7A,AD,CA,02,
     85,7B,AD,DA,02,CD,DB,02,90,0
     3,20,49,CB,20,73,2311
C3   1260 DATA 00,C9,5C,F0,0C,4C,
     E7,A7,AD,D9,02,F0,01,60,4C,A
     E,A7,A9,00,8D,D9,2692
0B   1270 DATA 02,20,73,00,C9,51,
     D0,03,4C,FB,C9,C9,52,D0,03,4
     C,BB,CC,C9,50,D0,2620
0B   1280 DATA 03,4C,E9,CC,8D,C0,
     02,20,73,00,8D,C1,02,20,73,0
     0,8D,C2,02,20,2C,1894
A5   1290 DATA C7,E6,7A,D0,02,E6,
     7B,20,8A,AD,20,F7,B7,A5,14,C
     9,05,90,05,A2,0E,2635
ED   1300 DATA 4C,37,A4,8D,C3,02,
     AD,D2,02,D0,0E,20,FD,AE,20,8
     A,AD,20,F7,B7,A5,2669
26   1310 DATA 14,8D,C5,02,AE,C3,
     02,20,87,C4,AD,C3,02,20,80,C
     8,B9,06,CD,8D,D5,2574
E0   1320 DATA 02,AD,C0,02,C9,4D,
     F0,2B,C9,53,F0,2A,C9,4F,F0,2
     9,C9,58,F0,28,C5,2827
7B   1330 DATA 59,F0,27,C9,56,F0,
     26,C9,43,F0,25,C9,46,F0,24,C
     9,42,F0,23,C9,48,2840
F2   1340 DATA F0,22,C9,41,F0,21,
     4C,53,C4,4C,F4,C2,4C,16,C3,4
     C,2A,C3,4C,37,C3,2614
C6   1350 DATA 4C,44,C3,4C,51,C3;
     4C,5E,C3,4C,6B,C3,4C,78,C3,4
     C,85,C3,4C,92,C3,2646
CD   1360 DATA AD,C1,02,C9,43,F0,
     0F,C9,55,F0,0E,C9,4E,F0,0D,C
     9,4F,F0,0C,4C,53,2654
78   1370 DATA C4,4C,9F,C3,4C,B3,
     C3,4C,C0,C3,4C,7A,C4,AD,C1,0
     2,C9,54,F0,07,C9,3034
E4   1380 DATA 48,F0,06,4C,53,C4,
     4C,CD,C3,4C,59,C4,AD,C1,02,C
     9,46,F0,03,4C,53,2551
C6   1390 DATA C4,4C,E1,C3,AD,C1,
     02,C9,50,F0,03,4C,53,C4,4C,E
     E,C3,AD,C1,02,C9,3017
3C   1400 DATA 50,F0,03,4C,53,C4,
     4C,FB,C3,AD,C1,02,C9,49,F0,0
     3,4C,53,C4,4C,08,2524
97   1410 DATA C4,AD,C1,02,C9,4F,
     F0,03,4C,53,C4,4C,15,C4,AD,C
     1,02,C9,52,F0,03,2629
4B   1420 DATA 4C,53,C4,4C,22,C4,
     AD,C1,02,C9,41,F0,03,4C,53,C
     4,4C,36,C4,AD,C1,2585
D7   1430 DATA 02,C9,49,F0,03,4C,
     53,C4,4C,43,C4,AD,C1,02,C9,4
     3,F0,03,4C,53,C4,2447
3F   1440 DATA 4C,6D,C4,AD,C2,02,
     C9,30,F0,07,C9,31,F0,06,4C,5
     3,C4,4C,1B,C9,4C,2477
70   1450 DATA 39,C9,AD,C2,02,C9,
     4C,F0,03,4C,53,C4,4C,34,C5,A
     D,C2,02,C9,4F,F0,2716
CF   1460 DATA 03,4C,53,C4,4C,52,
     C5,AD,C2,02,C9,58,F0,07,C9,5
     9,F0,06,4C,53,C4,2509
2E   1470 DATA 4C,70,C5,4C,8E,C5,
     AD,C2,02,C9,46,F0,03,4C,53,C
     4,4C,16,C5,AD,C2,2700
68   1480 DATA 02,C9,4F,F0,03,4C,
     53,C4,4C,24,C6,AD,C2,02,C9,4
```

```
    F,F0,03,4C,53,C4,2437
95  1490 DATA 4C,8F,C6,AD,C2,02,
    C9,53,F0,03,4C,53,C4,4C,F8,C
    4,AD,C2,02,C9,4C,2834
28  1500 DATA F0,03,4C,53,C4,4C,
    E8,C8,AD,C2,02,C9,54,F0,07,C
    9,4D,F0,06,4C,53,2690
51  1510 DATA C4,4C,E8,C5,4C,B8,
    C8,AD,C2,02,C9,48,F0,03,4C,5
    3,C4,4C,06,C6,AD,2857
2B  1520 DATA C2,02,C9,54,F0,03,
    4C,53,C4,4C,3E,C9,4C,2A,C2,2
    0,08,AF,4C,2A,C2,2257
B6  1530 DATA AD,C2,02,C9,58,F0,
    07,C9,59,F0,06,4C,53,C4,4C,A
    C,C5,4C,CA,C5,AD,2889
D3  1540 DATA C2,02,C9,54,F0,03,
    4C,53,C4,4C,C3,C9,AD,C2,02,C
    9,56,F0,03,4C,53,2609
BD  1550 DATA C4,4C,52,CA,A9,E8,
    85,FB,A9,CD,85,FC,E0,00,F0,1
    0,18,A5,FB,69,38,3181
D0  1560 DATA 85,FB,A5,FC,69,00,
    85,FC,CA,D0,F0,60,E0,08,90,0
    5,A2,0E,4C,37,A4,2889
06  1570 DATA E8,A9,00,38,2A,CA,
    D0,FC,11,FB,91,FB,60,E0,08,9
    0,05,A2,0E,4C,37,2609
56  1580 DATA A4,E8,A9,00,38,2A,
    CA,D0,FC,8D,C7,02,A9,FF,38,E
    D,C7,02,31,FB,91,3030
02  1590 DATA FB,60,E0,08,90,05,
    A2,0E,4C,37,A4,E8,A9,00,38,2
    A,CA,D0,FC,31,FB,2660
09  1600 DATA D0,04,8D,D4,02,60,
    A9,01,8D,D4,02,60,A0,15,AE,C
    5,02,20,A4,C4,AD,2403
3C  1610 DATA D5,02,F0,0E,AD,D2,
    02,F0,09,20,AA,C8,AE,C5,02,2
    0,A4,C4,4C,2A,C2,2582
36  1620 DATA A0,15,AE,C5,02,20,
    BA,C4,AD,D5,02,F0,0E,AD,D2,0
    2,F0,09,20,AA,C8,2646
87  1630 DATA AE,C5,02,20,BA,C4,
    4C,2A,C2,A0,1C,AE,C5,02,20,A
    4,C4,AD,D5,02,F0,2680
9C  1640 DATA 0E,AD,D2,02,F0,09,
    20,AA,C8,AE,C5,02,20,A4,C4,4
    C,2A,C2,A0,1C,AE,2489
E9  1650 DATA C5,02,20,BA,C4,AD,
    D5,02,F0,0E,AD,D2,02,F0,09,2
    0,AA,C8,AE,C5,02,2664
CE  1660 DATA 20,BA,C4,4C,2A,C2,
    A0,1D,AE,C5,02,20,A4,C4,AD,D
    5,02,F0,0E,AD,D2,2705
0D  1670 DATA 02,F0,09,20,AA,C8,
    AE,C5,02,20,A4,C4,4C,2A,C2,A
    0,17,AE,C5,02,20,2318
BE  1680 DATA A4,C4,AD,D5,02,F0,
    0E,AD,D2,02,F0,09,20,AA,C8,A
    E,C5,02,20,A4,C4,2803
24  1690 DATA 4C,2A,C2,A0,1D,AE,
    C5,02,20,BA,C4,AD,D5,02,F0,0
    E,AD,D2,02,F0,09,2564
85  1700 DATA 20,AA,C8,AE,C5,02,
    20,BA,C4,4C,2A,C2,A0,17,AE,C
    5,02,20,BA,C4,AD,2644
23  1710 DATA D5,02,F0,0E,AD,D2,
    02,F0,09,20,AA,C8,AE,C5,02,2
    0,BA,C4,4C,2A,C2,2604
80  1720 DATA A0,1B,AE,C5,02,20,
    BA,C4,AD,D5,02,F0,0E,AD,D2,0
    2,F0,09,20,AA,C8,2652
1A  1730 DATA AE,C5,02,20,BA,C4,
    4C,2A,C2,A0,1B,AE,C5,02,20,A
    4,C4,AD,D5,02,F0,2679
31  1740 DATA 0E,AD,D2,02,F0,09,
    20,AA,C8,AE,C5,02,20,A4,C4,4
    C,2A,C2,20,FD,AE,2586
E8  1750 DATA 20,8A,AD,20,F7,B7,
    AD,C5,02,0A,A8,A5,14,91,FB,A
    D,D5,02,F0,0E,AD,2751
FD  1760 DATA D2,02,F0,09,98,18,
    69,38,A8,A5,14,91,FB,A0,10,A
    E,C5,02,A5,15,F0,2522
F3  1770 DATA 22,C9,01,F0,03,4C,
    16,C5,20,A4,C4,AD,D5,02,F0,1
    0,AD,D2,02,F0,0B,2446
C1  1780 DATA 98,18,69,38,A8,AE,
    C5,02,20,A4,C4,4C,2A,C2,20,B
    A,C4,AD,D5,02,F0,2624
99  1790 DATA 10,AD,D2,02,F0,0B,
    98,18,69,38,A8,AE,C5,02,20,B
    A,C4,4C,2A,C2,20,2288
DC  1800 DATA FD,AE,20,8A,AD,20,
    F7,B7,AD,C5,02,0A,A8,C8,A5,1
    5,F0,03,4C,16,C5,2706
CF  1810 DATA A5,14,91,FB,8D,C8,
    02,20,89,C8,AE,D2,02,F0,03,4
    C,80,C7,4C,2A,C2,2637
99  1820 DATA A9,00,8D,D3,02,AE,
    C5,02,A0,17,20,D9,C4,AD,D4,0
    2,D0,3E,AD,C8,02,2556
76  1830 DATA C9,37,90,2B,C9,59,
    90,2D,EE,D3,02,C9,5F,90,20,C
    9,81,90,22,EE,D3,2802
A9  1840 DATA 02,C9,86,90,15,C9,
    A8,90,17,EE,D3,02,C9,AE,90,0
    A,C9,D0,90,0C,EE,2821
76  1850 DATA D3,02,4C,FE,C6,A9,
    00,8D,D6,02,60,A9,01,8D,D6,0
    2,60,AD,C8,02,C9,2562
9C  1860 DATA 59,90,F3,EE,D3,02,
    C9,81,90,EC,EE,D3,02,C9,A8,9
    0,E5,EE,D3,02,C9,3482
CE  1870 DATA D0,90,DE,EE,D3,02,
    4C,FE,C6,A5,7A,8D,C9,02,A5,7
    B,8D,CA,02,A9,00,2986
0F  1880 DATA 8D,D2,02,A9,80,8D,
    D1,02,8D,D0,02,A2,06,20,73,0
    0,C9,2C,F0,0D,C9,2367
C8  1890 DATA 25,F0,14,18,69,80,
    9D,CB,02,CA,D0,EC,AD,C9,02,8
    5,7A,AD,CA,02,85,2703
24  1900 DATA 7B,60,20,73,00,20,
    FA,AE,20,8A,AD,20,F7,B7,A5,1
    4,8D,C5,02,20,F7,2431
45  1910 DATA AE,A9,01,8D,D2,02,
    4C,59,C7,20,BA,C6,20,62,C8,A
    D,C5,02,8D,BD,02,2511
66  1920 DATA 20,8B,C1,AD,D6,02,
    F0,0C,EE,D3,02,20,62,C8,CE,D
    3,02,20,8B,C1,A0,2729
4B  1930 DATA 15,AE,C5,02,20,BA,
    C4,AD,C3,02,20,80,C8,B9,06,C
    D,F0,0F,AE,C3,02,2560
8C  1940 DATA E8,20,87,C4,A0,15,
    AE,C5,02,20,BA,C4,AE,D3,02,2
    0,87,C4,A0,15,AE,2668
D8  1950 DATA C5,02,20,A4,C4,AD,
    D6,02,F0,0F,AE,D3,02,E8,20,8
    7,C4,A0,15,AE,C5,2769
35  1960 DATA 02,20,A4,C4,AD,C3,
    02,20,80,C8,A9,00,99,06,CD,A
    D,D3,02,20,80,C8,2403
B9  1970 DATA AD,D6,02,99,06,CD,
    4C,FE,C7,A5,2F,85,FB,A5,30,8
    5,FC,A5,FB,C5,31,3138
CB  1980 DATA D0,06,A5,FC,C5,32,
    F0,32,A0,00,A2,06,B1,FB,DD,C
    B,02,D0,09,C8,CA,2969
E2  1990 DATA B1,FB,DD,CB,02,F0,
    23,18,A0,03,B1,FB,AA,88,B1,F
    B,65,FB,85,FB,8A,3352
CD  2000 DATA 65,FC,85,FC,A5,FB,
    C5,31,D0,D4,A5,FC,C5,32,D0,C
    E,A2,04,4C,37,A4,3359
FD  2010 DATA AD,C5,02,0A,18,65,
    FB,85,FB,A5,FC,69,00,85,FC,A
    D,D3,02,A0,08,91,2748
17  2020 DATA FB,4C,2A,C2,A9,E8,
    85,FD,A9,CD,85,FE,AE,D3,02,F
    0,10,18,A5,FD,69,3301
08  2030 DATA 38,85,FD,A5,FE,69,
    00,85,FE,CA,D0,F0,60,0A,0A,0
    A,18,6D,C5,02,A8,2629
D3  2040 DATA 60,98,AA,AD,C3,02,
    20,80,C8,B9,06,CD,F0,13,8A,A
    8,AE,C3,02,E8,20,2744
CF  2050 DATA 87,C4,A5,14,91,FB,
    AE,C3,02,20,87,C4,60,18,A5,F
    B,69,38,85,FB,A5,2892
41  2060 DATA FC,69,00,85,FC,60,
    20,FD,AE,20,8A,AD,20,F7,B7,A
    0,2F,AE,C5,02,E8,2914
10  2070 DATA CA,F0,04,C8,4C,C7,
    C8,A5,14,91,FB,AD,D5,02,F0,0
    E,AD,D2,02,F0,09,2978
DA  2080 DATA 98,18,69,38,A8,A5,
    14,91,FB,4C,2A,C2,20,FD,AE,2
    0,8A,AD,20,F7,B7,2662
DB  2090 DATA A9,27,18,6D,C5,02,
    C9,2F,B0,1B,A8,A5,14,91,FB,A
    D,D5,02,F0,0E,AD,2555
C9  2100 DATA D2,02,F0,09,98,18,
    69,38,A8,A5,14,91,FB,4C,2A,C
    2,A2,0E,4C,37,A4,2330
DD  2110 DATA A0,25,AD,C5,02,91,
    FB,AD,D5,02,F0,0F,AD,D2,02,F
    0,0A,98,18,69,38,2580
0C  2120 DATA A8,AD,C5,02,91,FB,
    4C,2A,C2,A0,26,4C,1D,C9,20,F
    D,AE,A5,7A,D0,02,2708
0C  2130 DATA C6,7B,C6,7A,AD,C5,
    02,48,20,2C,C7,68,8D,C5,02,E
    6,7A,D0,02,E6,7B,2719
7C  2140 DATA 20,8A,AD,A0,1F,AE,
    C5,02,20,D9,C4,AE,C5,02,20,B
    A,C4,AD,D5,02,D0,2735
6F  2150 DATA 16,AD,D4,02,D0,11,
    98,18,69,38,A8,AE,C5,02,20,D
    9,C4,AE,C5,02,20,2362
C4  2160 DATA BA,C4,AD,D4,02,0A,
    8D,D3,02,A0,1E,AE,C5,02,20,D
    9,C4,AE,C5,02,20,2546
A3  2170 DATA BA,C4,AD,D5,02,D0,
    16,AD,D4,02,D0,11,98,18,69,3
    8,A8,AE,C5,02,20,2522
FC  2180 DATA D9,C4,AE,C5,02,20,
    BA,C4,18,AD,D4,02,6D,D3,02,8
    D,D3,02,4C,FE,C7,2816
9E  2190 DATA 20,FD,AE,A5,7A,D0,
    02,C6,7B,C6,7A,AD,C5,02,48,2
    0,2C,C7,68,8D,C5,2758
1E  2200 DATA 02,E6,7A,D0,02,E6,
    7B,AD,D2,02,D0,03,4C,53,C4,2
    0,8A,AD,A0,15,AE,2566
8A  2210 DATA C5,02,20,D9,C4,AD,
    D4,02,8D,D3,02,4C,FE,C7,78,A
    9,31,8D,14,03,A9,2585
12  2220 DATA EA,8D,15,03,A9,FE,
    2D,1A,D0,8D,1A,D0,58,A9,E4,8
    D,08,03,A9,A7,8D,2590
0C  2230 DATA 09,03,A9,00,8D,15,
    D0,E6,7A,D0,02,E6,7B,4C,2A,C
    2,A0,2A,A9,00,99,2302
98  2240 DATA 05,CD,88,D0,FA,A2,
    E8,86,FB,A2,CD,86,FC,A2,09,A
    9,00,91,FB,E6,FB,3553
6E  2250 DATA D0,02,E6,FC,A5,FB,
    C9,00,D0,F0,A5,FC,C9,D0,D0,E
    A,60,AD,D2,02,D0,3714
E8  2260 DATA 03,4C,53,C4,A0,00,
    A2,14,B9,00,CF,D0,07,C8,B9,0
    0,CF,F0,0E,88,98,2441
07  2270 DATA 18,69,0C,A8,CA,D0,
    EC,A2,0F,4C,37,A4,88,8C,D7,0
    2,20,FD,AE,20,8A,2549
7F  2280 DATA AD,20,BF,B1,A5,65,
    AC,D7,02,99,02,CF,20,FD,AE,2
    0,8A,AD,20,BF,B1,2792
E4  2290 DATA A5,65,AC,D7,02,99,
    03,CF,20,FD,AE,20,8A,AD,20,F
    7,B7,A5,14,AC,D7,2854
F4  2300 DATA 02,8D,DC,02,A5,15,
    8D,DD,02,AD,D1,02,99,04,CF,A
    D,D0,02,99,05,CF,2411
15  2310 DATA AD,C3,02,99,06,CF,
    AD,C5,02,99,07,CF,20,FD,AE,A
```

```
    5,7A,D0,02,C6,7B,2752
CE  2320 DATA C6,7A,AD,C5,02,48,
    20,2C,C7,68,8D,C5,02,E6,7A,D
    0,02,E6,7B,20,8A,2568
62  2330 DATA AD,AD,D2,02,D0,03,
    4C,53,C4,AC,D7,02,AD,D1,02,9
    9,08,CF,AD,D0,02,2648
D2  2340 DATA 99,09,CF,20,FD,AE,
    A5,7A,D0,02,C6,7B,C6,7A,AD,C
    5,02,48,20,2C,C7,2685
9D  2350 DATA 68,8D,C5,02,E6,7A,
    D0,02,E6,7B,20,8A,AL,AD,D2,0
    2,D0,03,4C,53,C4,2653
C3  2360 DATA AC,D7,02,AD,D1,02,
    99,0A,CF,AD,D0,02,99,0B,CF,A
    D,DC,02,AC,D7,02,2681
77  2370 DATA 99,00,CF,AD,DD,02,
    99,01,CF,4C,2A,C2,A9,01,8D,D
    9,02,8D,D2,02,A0,2472
33  2380 DATA 00,A2,14,8E,D8,02,
    B9,00,CF,D0,1B,C8,B9,00,CF,D
    0,14,88,98,18,69,2406
27  2390 DATA 0C,A8,CE,D8,02,D0,
    EA,A9,00,8D,D9,02,8D,DA,02,6
    0,88,8C,D7,02,38,2581
34  2400 DATA B9,00,CF,E9,01,99,
    00,CF,B9,01,CF,E9,00,99,01,C
    F,B9,07,CF,8D,C5,2710
9C  2410 DATA 02,20,4C,CC,AE,D7,
    02,A0,08,18,BD,02,CF,71,FB,9
    1,FB,85,14,88,BD,2533
45  2420 DATA 02,CF,30,05,A9,00,
    4C,B1,CB,A9,FF,71,FB,91,FB,8
    5,15,C9,02,90,09,2581
EF  2430 DATA 20,1E,CC,20,16,C5,
    4C,AD,CC,20,1E,CC,20,2D,C6,1
    8,AD,D7,02,69,02,2032
86  2440 DATA 8D,D7,02,20,4C,CC,
    38,AD,D7,02,E9,02,8D,D7,02,A
    E,D7,02,A0,08,18,2292
F3  2450 DATA BD,03,CF,71,FB,91,
    FB,85,14,88,BD,03,CF,30,05,A
    9,00,4C,FB,CB,A9,2768
F4  2460 DATA FF,71,FB,91,FB,85,
    15,F0,09,20,1E,CC,20,16,C5,4
    C,AD,CC,20,1E,CC,2654
02  2470 DATA 20,98,C6,AC,D7,02,
    AD,D3,02,99,06,CF,4C,64,CB,A
    C,D7,02,B9,04,CF,2687
4E  2480 DATA 8D,D1,02,B9,05,CF,
    8D,D0,02,B9,06,CF,8D,C3,02,B
    9,07,CF,8D,C5,02,2575
16  2490 DATA AE,C3,02,20,87,C4,
    AD,C3,02,20,80,C8,B9,06,CD,8
    D,D5,02,60,A5,2F,2524
F2  2500 DATA 85,FB,A5,30,85,FC,
    A5,2F,C5,31,D0,09,A5,30,C5,3
    2,D0,03,4C,BB,CC,2795
47  2510 DATA AE,D7,02,A0,00,B1,
    FB,DD,08,CF,D0,08,C8,B1,FB,D
    D,09,CF,F0,26,18,2998
EF  2520 DATA A0,03,B1,FB,AA,88,
    B1,FB,65,FB,85,FB,8A,65,FC,8
    5,FC,A5,FB,C5,31,3599
A3  2530 DATA D0,D4,A5,FC,C5,32,
    D0,CE,20,BB,CC,A2,04,4C,37,A
    4,AD,C5,02,0A,18,2788
25  2540 DATA 65,FB,85,FB,A5,FC,
    69,00,85,FC,60,A9,00,AC,D7,0
    2,99,00,CF,99,01,2811
FE  2550 DATA CF,4C,64,CB,A9,00,
    85,FB,A9,CF,85,FC,A0,00,A9,0
    0,91,FB,C8,D0,FB,3284
5A  2560 DATA A9,06,85,FB,A9,CD,
    85,FC,A9,00,91,FB,C8,C0,29,D
    0,F9,20,03,C0,E6,3230
ED  2570 DATA 7A,D0,02,E6,7B,4C,
    2A,C2,E6,7A,D0,02,E6,7B,20,8
    A,AD,20,F7,B7,A5,2882
AE  2580 DATA 14,C9,C9,B0,06,8D,
    D8,02,4C,2A,C2,A2,0E,4C,37,A
    4,00,00,00,00,00,1749
```

PROGRAM: DEMO SET-UP

```
AF  10 REM*********************
46  20 REM MOVE BOTTOM OF BASIC
BB  30 REM*********************
D3  40 POKE43,1:POKE44,10:POKE25
    60,0:NEW
```

PROGRAM: SPLIT-DEMO

```
A3  100 REM********************
33  110 REM READ IN SPRITE DATA
BF  120 REM********************
E2  130 A=2048:B=10000
60  140 FORZ=0TO24:C=0:FORY=0TO2
    0
71  150 READD$
69  160 HB$=LEFT$(D$,1):LB$=RIGH
    T$(D$,1)
2A  170 HB=VAL(HB$):IFASC(HB$)>5
    7THENHB=ASC(HB$)-55
B8  180 LB=VAL(LB$):IFASC(LB$)>5
    7THENLB=ASC(LB$)-55
55  190 D=HB*16+LB:C=C+D
77  200 IFA<2560THENPOKEA,D
5B  210 A=A+1:NEXT
F3  220 READ CHECK:IF CHECK<>C T
    HEN GOTO 240
3C  230 PRINTB:B=B+10:NEXT:GOTO2
    50
3C  240 PRINT"ERROR IN LINE"B:ST
    OP
35  250 REM********************
    *
F6  260 REM PART 1: SET-UP ZONE
    0
80  270 REM********************
    *
C3  280 SYS49152:REM COLD START
71  290 PRINT"[CLR]"
FB  300 £P 200:REM PACE BASIC FA
    ST/SPRITES SLOW
71  310 ZN=0:REM** ZN= ZONE (0-4
    )
A8  320 £MCO ZN,0:REM SET MULTIC
    OLOR 0 TO BLACK
16  330 £MC1 ZN,14:REM SET MULTI
    COLOR 1 TO LT BLUE
85  340 FOR SP=0 TO 7:REM** SP=S
    PRITE (0-7)
D1  350 £MUL ZN,SP:REM** MULTICO
    LOUR ON
3E  360 READ F,C,X,Y
6D  370 A%(SP)=ZN:AX%(SP)=X:AY%(
    SP)=Y
7B  380 £FRM A%(SP),F:REM** SET
    SPRITE POINTER
0B  390 £COL A%(SP),C:REM** SET
    COLOUR
CC  400 £XPO A%(SP),X:REM** X CO
    -ORDINATE
3D  410 £YPO A%(SP),Y:REM** Y CO
    -ORDINATE
82  420 £VIS A%(SP):REM** ENABLE
    SPRITE
2D  430 NEXT
52  440 REM***************
9F  450 REM SET-UP ZONE 1
5E  460 REM***************
9A  470 ZN=1
19  480 £MCO ZN,0
4D  490 £MC1 ZN,14
F0  500 FOR SP=0 TO 7
12  510 £MUL ZN,SP
5D  520 READ F,C,X,Y
E9  530 B%(SP)=ZN:BX%(SP)=X:BY%(
    SP)=Y
2C  540 £FRM B%(SP),F
CE  550 £COL B%(SP),C
34  560 £XPO B%(SP),X
C0  570 £YPO B%(SP),Y
D9  580 £VIS B%(SP)
D2  590 NEXT
D5  600 REM***************
27  610 REM SET-UP ZONE 2
A1  620 REM***************
F4  630 ZN=2
B8  640 £MCO ZN,0
76  650 £MC1 ZN,14
D1  660 FOR SP=0 TO 7
9B  670 £MUL ZN,SP
7D  680 READ F,C,X,Y
30  690 C%(SP)=ZN:CX%(SP)=X:CY%(
    SP)=Y
8F  700 £FRM C%(SP),F
2F  710 £COL C%(SP),C
D3  720 £XPO C%(SP),X
21  730 £YPO C%(SP),Y
B8  740 £VIS C%(SP)
72  750 NEXT
35  760 REM***************
47  770 REM SET-UP ZONE 3
80  780 REM***************
56  790 ZN=3
D3  800 £MCO ZN,0
97  810 £MC1 ZN,14
B2  820 FOR SP=0 TO 7
74  830 £MUL ZN,SP
9C  840 READ F,C,X,Y
12  850 D%(SP)=ZN:DX%(SP)=X:DY%(
    SP)=Y
61  860 £FRM D%(SP),F
0F  870 £COL D%(SP),C
31  880 £XPO C%(SP),X
0F  890 £YPO D%(SP),Y
98  900 £VIS D%(SP)
13  910 NEXT
14  920 REM***************
E0  930 REM SET-UP ZONE 4
E0  940 REM***************
B7  950 ZN=4
73  960 £MCO ZN,0
37  970 £MC1 ZN,14
92  980 FOR SP=0 TO 7
D4  990 £MUL ZN,SP
BC  1000 READ F,C,X,Y
A3  1010 E%(SP)=ZN:EX%(SP)=X:EY%
    (SP)=Y
C0  1020 £FRM E%(SP),F
6F  1030 £COL E%(SP),C
97  1040 £XPO E%(SP),X
6D  1050 £YPO E%(SP),Y
4C  1060 £VIS E%(SP)
B0  1070 NEXT
F1  1080 REM*******************
    *******
41  1090 REM PART 2: MOVE THINGS
     AROUND
5D  1100 REM*******************
    *******
E7  1110 PRINT"[DOWN3]"TAB(7)"PR
    ESS SPACE BAR FOR ACTION!"
4F  1120 GETA$:IFA$<>" "GOTO1120

B1  1130 PRINT"[CLR]":FORSP=1TO7
    STEP2
55  1140 £MOV A%(SP),0,-2,70,AX%
    (SP),AY%(SP)
1B  1150 NEXT:£PO:REM** BASIC SL
    OW/SPRITES FAST
46  1160 Z0%(0)=0
AB  1170 £ACT 0,1,Z0%(1):IFZ0%(1
    )>0GOTO1170:REM** HAVE SPRIT
```

```
     ES CLEARED ZONE 0 ?
6F   1180 £P200:FORSP=1TO7 STEP2
9E   1190 £MOV B%(SP),0,-3,100,BX
     %(SP),BY%(SP):REM** ZONE 0 C
     LEAR, SO MOVE ZONE 1 UP
4C   1200 NEXT:£PO
53   1210 Z1%(0)=0
B8   1220 £ACT 1,7,Z1%(7):IFZ1%(7
     )>0GOTO1220
E1   1230 £P200:FORSP=1TO7 STEP2
5C   1240 £MOV C%(SP),0,-3,140,CX
     %(SP),CY%(SP)
22   1250 NEXT:£PO
B8   1260 Z2%(0)=0
32   1270 £ACT 2,7,Z2%(7):IFZ2%(7
     )>0GOTO1270
D4   1280 £P200:FORSP=1TO7 STEP2
B6   1290 £MOV D%(SP),0,-3,160,DX
     %(SP),DY%(SP)
96   1300 NEXT:£PO
48   1310 Z3%(0)=0
8D   1320 £ACT 3,7,Z3%(0):IFZ3%(7
     )>0GOTO1320
86   1330 £P200:FORSP=1TO7 STEP2
DC   1340 £MOV E%(SP),0,-3,130,EX
     %(SP),EY%(SP)
9F   1350 NEXT:£PO
65   1360 ES%(0)=0
45   1370 £ACT E%(1),ES%(1):IFES%
     (1)>0 GOTO1370
80   1380 £P200:FORSP=0 TO 6 STEP
     2
95   1390 £MOV A%(SP),0,4,70,AX%(
     SP),AY%(SP)
85   1400 NEXT:£PO
FF   1410 AS%(0)=0
B2   1420 £ACT A%(0),AS%(0):IFAS%
     (0)>0 GOTO1420
3E   1430 REM********************
     *******
5B   1440 REM PART 3: CHANGING PR
     IORITY
8A   1450 REM********************
     *******
B3   1460 £P200:PRINT"[CLR,DOWN8]
     "
DC   1470 FOR BLOB=0TO9
0C   1480 PRINTTAB(15)"[YELLOW,CK
     12]"
55   1490 NEXT
52   1500 PRINTTAB(7)"[DOWN3,BLAC
     K]PRESS SPACE BAR WHEN BORED
     "
95   1510 AX%(0)=100:AY%(0)=160:£
     COL A%(0),0:£PO
C6   1520 £FRT A%(0):REM** SPRITE
      IN FRONT
DF   1530 £MOV A%(0),4,0,42,AX%(0
     ),AY%(0)
8F   1540 GETA$:IFA$=" "GOTO1610
0E   1550 IFAX%(0)<268GOTO1540
CF   1560 £BAK A%(0):REM** SPRITE
      AT BACK
85   1570 £MOV A%(0),-4,0,42,AX%(
     0),AY%(0)
67   1580 GETA$:IFA$=" "GOTO1610
28   1590 IFAX%(0)>100GOTO1590
57   1600 GOTO1520
33   1610 REM********************
     ******
C5   1620 REM PART 4:STRETCHING S
     PRITES
4F   1630 REM********************
     ******
CD   1640 PRINT"[CLR]":£P200:£OFF
     A%(0):£R:REM** RESET SPRITE
     LINKS AND £MOV TABLE
94   1650 FORSP=0TO6
0E   1660 A%(SP)=0
2F   1670 £YPO A%(SP),50
CD   1680 £XPO A%(SP),15+(SP*48)
3C   1690 £STX A%(SP):REM** STRET
     CH IN X
CE   1700 £VIS A%(SP)
8C   1710 E%(SP)=4
0C   1720 £STY E%(SP):REM** STRET
     CH IN Y
D8   1730 £YPO E%(SP),208
95   1740 £XPO E%(SP),15+(SP*48)
03   1750 £STX E%(SP)
B6   1760 £VIS E%(SP)
72   1770 NEXT
35   1780 FORSP=0TO1
74   1790 C%(SP)=2
19   1800 £STY C%(SP)
C5   1810 £YPO C%(SP),130
D9   1820 £XPO C%(SP),24+(SP*296)

43   1830 £VIS C%(SP)
5C   1840 NEXT:PRINTTAB(19)"[BLAC
     K,DOWN2,SQ2]"
26   1850 REM********************
     ********
D7   1860 REM PART 5: COLLISION D
     ETECTION
82   1870 REM********************
     ********
AA   1880 A%(7)=0:AH%(7)=0:DA=6:A
     Y%(7)=90
96   1890 £YPO A%(7),AY%(7)
FE   1900 £XPO A%(7),172
A8   1910 £HIT A%(7),AH%(7)
2F   1920 £VIS A%(7)
FD   1930 C%(6)=2:CH%(6)=0:DC=-10
     :CX%(6)=60
9B   1940 £YPO C%(6),140
02   1950 £XPO C%(6),CX%(6)
6C   1960 £HIT C%(6),CH%(6)
2C   1970 £VIS C%(6)
34   1980 £HIT A%(7),AH%(7):£HIT
     C%(6),CH%(6):REM** TEST ONCE
      TO CLEAR REGISTER
59   1990 £HIT A%(7),AH%(7):£HIT
     C%(6),CH%(6):REM** TEST TWIC
     E FOR COLLISION
48   2000 IFAH%(7)>0 THEN DA=-DA:
     REM** IF B.G. COLLISION THEN
      CHANGE DIRECTION
8D   2010 IFCH%(6)=1 THEN DC=-DC:
     REM** IF SPRITE COLLISION TH
     EN CHANGE DIRECTION
75   2020 AY%(7)=AY%(7)+DA:£YPO A
     %(7),AY%(7)
D5   2030 CX%(6)=CX%(6)+DC:£XPO C
     %(6),CX%(6)
E6   2040 GOTO1980
8A   2050 END
E3   2060 REM*************
7A   2070 REM SPRITE DATA
BF   2080 REM*************
4E   2090 DATA AA,AA,AA,80,00,02,
     80,3D,02,80,D3,42,83,40,D2,8
     3,43,D2,83,43,D2,2457
B2   2100 DATA 83,4D,D2,83,4D,D2,
     83,4D,D2,83,74,D2,83,74,D2,8
     3,74,D2,83,D0,D2,3174
81   2110 DATA 83,D0,D2,83,D0,D2,
     83,40,D2,80,D3,42,80,3D,02,8
     0,00,02,AA,AA,AA,2739
5E   2120 DATA ED,AA,AA,AA,80,00,
     02,80,3D,02,80,FD,02,80,3D,0
     2,80,3D,02,80,3D,2022
7E   2130 DATA 02,80,3D,02,80,3D,
     02,80,3D,02,80,3D,02,80,3D,0
     2,80,3D,02,80,3D,1337
77   2140 DATA 02,80,3D,02,80,3D,
     02,80,3D,02,80,3D,02,80,FF,4
     2,80,00,02,AA,AA,1685
DC   2150 DATA AA,04,AA,AA,AA,80,
     00,02,80,3D,02,80,D3,42,83,4
     0,D2,83,40,D2,80,2348
95   2160 DATA 00,D2,80,00,D2,80,
     00,D2,80,00,D2,80,03,42,80,0
     3,42,80,0D,02,80,1889
7E   2170 DATA 0D,02,80,34,02,80,
     34,02,80,D0,02,80,D0,02,83,F
     F,D2,80,00,02,AA,1951
BD   2180 DATA AA,AA,AD,AA,AA,AA,
     80,00,02,80,FD,02,83,43,42,8
     0,00,D2,80,00,D2,2476
E0   2190 DATA 80,00,D2,80,00,D2,
     80,00,D2,80,03,42,80,3D,02,8
     0,03,42,80,00,D2,1937
89   2200 DATA 80,00,D2,80,00,D2,
     80,00,D2,80,00,D2,83,43,42,8
     0,FD,02,80,00,02,2129
55   2210 DATA AA,AA,AA,00,AA,AA,
     AA,80,00,02,80,00,02,80,0F,4
     2,80,3F,42,80,3F,1937
5D   2220 DATA 42,80,DF,42,80,DF,
     42,83,4F,42,83,4F,42,83,4F,4
     2,8D,0F,42,8D,0F,2106
0B   2230 DATA 42,8F,FF,D2,8F,FF,
     D2,80,0F,42,80,0F,42,80,0F,4
     2,80,3F,D2,80,00,2438
47   2240 DATA 02,AA,AA,AA,A9,AA,
     AA,AA,80,00,02,83,FF,D2,83,D
     0,02,83,D0,02,83,2730
84   2250 DATA D0,02,83,D0,02,83,
     D0,02,83,D0,02,83,FD,02,80,0
     F,42,80,03,D2,80,2297
7B   2260 DATA 00,D2,80,00,D2,80,
     00,D2,80,00,D2,80,03,D2,80,0
     F,42,83,FD,02,80,2288
F2   2270 DATA 00,02,AA,AA,AA,08,
     AA,AA,AA,80,00,02,80,3D,02,8
     0,D3,42,80,D3,42,2161
A4   2280 DATA 83,40,D2,83,40,D2,
     83,40,02,83,7D,02,83,FF,42,8
     3,C3,D2,83,40,D2,2658
91   2290 DATA 83,40,D2,83,40,D2,
     83,40,D2,83,40,D2,80,D3,42,8
     0,D3,42,80,3D,02,2621
77   2300 DATA 80,00,02,AA,AA,AA,
     8F,AA,AA,AA,80,00,02,83,FF,D
     2,83,FF,D2,80,00,2743
C1   2310 DATA D2,80,00,D2,80,03,
     42,80,03,42,80,03,42,80,0D,0
     2,80,0D,02,80,0D,1566
2B   2320 DATA 02,80,0D,02,80,34,
     02,80,34,02,80,34,02,80,34,0
     2,80,34,02,80,34,1235
BC   2330 DATA 02,80,00,02,AA,AA,
     AA,EF,00,00,00,00,00,00,00,0
     0,00,00,00,00,00,881
6E   2340 REM********************
     **
06   2350 REM FRAME,COLOUR,X,Y DA
     TA
8A   2360 REM********************
     **
6E   2370 DATA 32,3,24,50,33,4,66
     ,50,34,5,108,50,35,7,150,50
87   2380 DATA 36,8,192,50,37,10,
     234;50,38,12,276,50,39,13,32
     0,50
A2   2390 DATA 32,3,24,90,33,4,66
     ,90,34,5,108,90,35,7,150,90
93   2400 DATA 36,8,192,90,37,10,
     234,90,38,12,276,90,39,13,32
     0,90
1C   2410 DATA 32,3,24,130,33,4,6
     6,130,34,5,108,130,35,7,150,
     130
D5   2420 DATA 36,8,192,130,37,10
     ,234,130,38,12,276,130,39,13
     ,320,130
70   2430 DATA 32,3,24,170,33,4,6
     6,170,34,5,108,170,35,7,150,
     170
D9   2440 DATA 36,8,192,170,37,10
     ,234,170,38,12,276,170,39,13
     ,320,170
B2   2450 DATA 32,3,24,210,33,4,6
     6,210,34,5,108,210,35,7,150,
     210
13   2460 DATA 36,8,192,210,37,10
     ,234,210,38,12,276,210,39,13
     ,320,210
```

NEW Mk III

NOW THE FIRST OF A NEW GENERATION OF BACKUP CARTRIDGE

Innovative new hardware design and programming techniques have allowed us to produce a cartridge of a calibre never seen before!!!

Action Replay Mk III is more powerful, more friendly, has more features and will back-up more programs than any competing utility —even the latest protected progams!!

ACTION REPLAY III

Works by taking a "Snapshot" of the program in memory – so it doesn't matter how the program was loaded –from tape or disk – at normal or turbo speed. EVEN SO CALLED "ANTI-FREEZE" PROGRAMS.

ONLY £29.99 POST FREE

ACTION... REPLAY

NEW Mk III VERSION

JUST LOOK AT THE FEATURES

So simple to use: Just press the button and make a complete backup: Tape to Tape, Tape to Disk, Disk to Disk, Disk to Tape.
– THE PROCESS IS AUTOMATIC – JUST GIVE THE BACKUP A NAME –



- All backups will reload at turbo speed independently of the cartridge.
- Dual speed tape turbo system programs can load up to 3 times faster than commercial turbos –thats over 10 times normal Commodore speed.
- Freeze the action then view the program with the monitor feature. Add pokes for infinite lives etc. Then Restart the game or backup – ideal for customised versions of your games.
- Special compacting techniques. Each program is saved as a single file.
- Transfers multistage tape programs to disk – more than any other cartridge – even the extra stages are turbo load – a unique feature.
- Sprite Killer! make yourself indestructible by disabling Sprite collisions in games.
- Picture Save. Save any multi-colour. Hires screen to disk or tape. Compatible with Blazing Paddles, Koala, Slideshow etc.
- Fully compatible with 1541, 1541C, 1570, 1571, and enhancer or any CBM compatible data recorder.
- For C64, 64C, 128, 128D (in 64 mode).
- Unique Sprite Monitor. Freeze the Action and view all the Sprites, watch the animations scroll across the screen. Save Sprites to disk or tape. Customize your games by loading Sprites from one game to another – then restart the program or make a backup.
- Compatible with fast DOS and Turbo ROM systems.
- Backup process in turbo speed – faster than any rivals.
- Fast disk format (20 secs).
- Built-in Unstoppable reset button.

FASTLOADER

Action Replay III even has a built in disk fast loader which speeds up loading 5 times. Uses no memory – invisible to the system. **You could pay £20 alone for this feature.**

PERFORMANCE GUARANTEE

100% SUCCESS? RIVAL CLAIMS? WHO'S KIDDING WHO? "Action Replay Mk 3 will backup any program which any other cartridge can backup – and more! It also has an unmatchable range of features. Consider 'Freeze-Frame' for example, which uses more disk space, saves at slower speed, has slower tape loader, has no built in disk fastloader, no picture, Sprite or restart features and costs £10 more than Action Replay. So who's kidding who? Buy Action Replay Mk 3. If you find that it does not live up to our claims return it within 7 days of receipt and your money will be refunded.

SEE DISKMATE AD FOR COMBO OFFER

ACTION REPLAY ENHANCEMENT DISK

Extending Action Replay's capabilities even further, this disk, contains a collection of tape to disk routines for a few newer games which load subsequent parts in a non-standard way. All the latest titles are catered for – more than any competing utility, and unlike other systems, ACTION REPLAY LOADS EXTRA SECTIONS AT TURBO SPEED. Disk includes file copy, disk backup and other useful utilities. Regular updates at low cost for use with Action Replay only. **Disk £7.95.**

GRAPHICS SLIDESHOW SOFTWARE

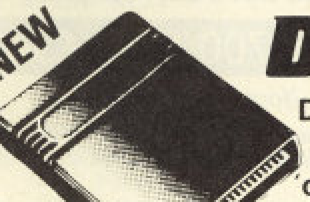
Cartridge based backup systems usually destroy loading pictures – NOT WITH ACTION REPLAY. Multicolour pictures from games, graphic packages or loading screens can be saved to disk using Action Replay and viewed singly or in sequence with this sophisticated slideshow package. Turboload throughout. Sixteen pictures per disk. Joystick or keyboard control. An interesting new use for your computer. **Disk £4.95.**

SPECIAL!! ENHANCEMENT DISK AND SLIDESHOW TOGETHER ONLY £11.99

NEW

Disk Mate II (TM)

DISK UTILITY CARTRIDGE



only £14.99 POST FREE

Built-in Reset Switch

If you have a disk drive then you **need** a Diskmate!!

- Diskmate* is a fast disk turbo loader that will speed up your normal loading software by 5 times.

BUT THAT'S NOT ALL

- Fast save
- Fast format (approx 10 seconds)
- Improved single stroke DOS commands ie. load, save, directory, scratch, etc.
- Redefined function keys: ie. load, load/run, list, directory, monitor, etc.
- Powerful toolkit commands: ie. old, delete, merge, copy, append, autonum, linesave etc., etc.

PLUS A powerful machine code monitor/disassembler. All the usual monitor commands: assemble, disassemble, move, find, compare, fill, number conversion etc., etc. **NB.** This is a full monitor, not a token effort like some available.

* Diskmate incorporates special switching techniques which make it "invisible" to the system. Therefore the fastload will work with more software than other types. In addition this makes the other commands including the monitor more powerful. For instance the monitor 'floats' and is able to look under ROMs and even under itself!

SPECIAL OFFERS

Buy Action Replay III and Diskmate together on the same cartridge for only. . . . This must surely be the most powerful cartridge available for the Commodore	£39.99 POST FREE
Buy Action Replay III and Fast Hack'em for. . . .	£44.99 POST FREE
Buy Action Replay III and Diskmate II on the same cartridge plus Fast Hack'em for. . . .	£54.99 POST FREE

Diskmate II was designed by Datel and the programming is by Dosoft. Need we say more?

IT'S HERE... **AMERICA'S BEST SELLING DISK BACKUP SYSTEM NOW AVAILABLE IN THE UK!**

FAST HACK'EM (TM)

BY MIKE J HENRY

FOR THE COMMODORE 64/128

A MULTI-MODULE SYSTEM - ALL ON ONE DISK

£19.99 POST FREE

SIMPLE TO USE FULLY MENU DRIVEN

FAST HACK'EM IS QUITE SIMPLY THE BEST DISK COPYING SYSTEM AVAILABLE, ANYWHERE AT ANY PRICE.

****WARNING****
FAST HACK'EM IS A VERY EFFECTIVE PRODUCT DESIGNED TO ENABLE USERS TO MAKE BACK UP FOR THEIR OWN USE – DATEL IN NO WAY CONDONES SOFTWARE PIRACY.

SINGLE 1541 MODULE

- AUTO NIBBLER: Copy an entire protected disk in 3 minutes. Automatically senses type of protection and treats it as normal data to produce working copy.
- NIBBLER: Copy and entire disk in 2 minutes. As above but parameters can be set manually.
- FAST COPY: Copy a disk in under 3 minutes.
- FILE COPY: Copy and file in 9 seconds.
- FAT TRACKER: Fat tracks are amongst the latest forms of protection. This mode allows you to produce a fat track on the disk.

SINGLE 1571 DRIVE (64 OR 128 MODE)

- FAST COPY: Entire 1571 disk in under 1 minute
- SINGLE OR BOTH SIDES: Will copy C64 or true 128 software
- C64 or 128 Modes

BECAUSE FAST HACK'EM IS PRODUCED IN THE U.S. IT WILL ALWAYS BE ON TOP OF THE LATEST PROTECTION TECHNIQUES. SINCE MANY OF OUR LATEST PROGAMS APPEARED IN THE U.S. MANY MONTHS

TWIN 1541 DRIVES MODULE

- AUTO NIBBLER: Copy an entire protected disk in under 1 minute. Features auto track/sector analyzer.
- FAST COPY: Copy entire disk in 36 seconds with verify.
- AUTOMATIC FASTCOPY: As above but with completely automatic operation. In fact once set up doesn't even need the computer. A must for duplicating disks on a large scale.

1541 PARAMETERS MODULE

This is the module that gives Fast Hack'em its power. The parameters module contains dozens of "Parameter Keys" that are used to unlock those heavily protected programs. Each parameter is designed for a particular software brand or even a particular program. Other copy programs may make strong claims, but without special parameters they just can't cope. Datel will be offering updates to Fast Hack'em on a quarterly basis, featuring 20-50 new parameters plus other improvements as they're made. Prices to be £6 plus old disk.

SPECIAL OFFER! QuickShot II ONLY **£6.99** or for C16 including interface **£8.99** POST FREE

...ve wear on your expansion port: 3 slot motherboard for 64/128

ONLY **£16.99** POST FREE

- ☐ ACCEPTS 3 CARTRIDGES
- ☐ SWITCH IN/OUT ANY SLOT
- ☐ ON BOARD SAFETY FUSE
- ☐ HIGH GRADE PCB/CONNECTORS
- ☐ RESET SWITCH

...VAILABLE NOW!!

Now a full Midi Interface for your 64/128 at a realistic price! POST FREE

NOW ONLY **£24.99**

- ☐ MIDI IN
- ☐ MIDI THRU
- ☐ 2x MIDI OUT
- ☐ Compatible with most leading software packages:
- • Advanced Music System • JMS • SEIL, etc.

Special Offer! Buy Midi Interface + advanced music system only £49.99 + £2 postage (disk only).

COMPUTER DATA RECORDER

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- ☐ QUALITY COMMODORE COMPATIBLE DATA RECORDER.
- ☐ PAUSE CONTROL ☐ COUNTER.
- ☐ SUITABLE FOR 128/64.
- ☐ ALSO AVAILABLE FOR: C16/PLUS 4 PLEASE ADD £1.00.
- ☐ SEND NOW FOR QUICK DELIVERY.

MODEL + ROBOTIC CONTROL MADE EASY WITH ROBOTEK 64

£39.99 POST FREE

Robotek 64 is a comprehensive hardware/software package to interface your 64 to the outside world, models, robots, lighting, sensors etc., etc. The features make Robotic 64 the most sophisticated unit available at any price:

• 4 output channels each with on board relay. • 4 digital inputs fully buffered. • Analogue input with full 8 bit conversion. • Sound input for voice recognition and voice controlled switching.

☐ Software features: sequencers to control output. Analogue measuring module. Test Program. Voice Activation Module, much, more. Voice recognition software to be released soon. Total package no more to buy!

COM-DRUM

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DIGITAL DRUM SYSTEM

SPECIAL OFFER AUDIO/TV LEAD (WORTH £4) FREE!!

Now with the Com-Drum digital system you can produce studio quality drum rhythms with real drum sounds. All the features of systems 10 times the price.

- • A complete digitally recorded drum kit, i.e. 8 voices – kick drum, snare, tom-tom, hi-hat, cymbal etc. etc. N.B. these are real drum sounds – not synthesized.
- • Real time and step time sequences • Full editing system. • 16 Alternative voices supplied free.
- • 8 pre programmed rhythms to start you off.
- • External sync facility. • Very simple to use.
- • Line output to hi-fi amp or through TV with optional audio TV lead (see offer). • On screen menus. • Stylish case. • Please state tape or disk software.

COM-DRUM EDITOR

Enables you to construct your own drumkits. 24 Drum sounds supplied on disk which you can arrange yourself to make custom kits. Names are then added and saved as a complete set for use in the Com-Drum. Existing kits as supplied with Com-Drum can also be editing to your choosing. Available on Disk only **£4.99** post free.

NEW Turbo Rom II

Replacement Kernal. New upgraded routines! PLUS

Fast Format / Fast Save

POST FREE! **£14.99**

Turbo Rom actually fits inside your computer and replaces the normal slow Kernal Rom with superfast disc loading routines plus extended DOS commands

- • Loads most programs at 5-6 times speed
- • Improved single key commands
- • Fits inside computer so all ports are free
- • Return to normal kernal at flick of switch
- • Fitted in minutes – no soldering usually needed (on a few C64's the old Rom may have to be de soldered)

Turbo Rom I can be upgraded for **£5** plus old chip.

NEW smart cart

An 8K or 32K pseudo ROM cartridge

£14.99 8K version — **£29.99** 32K version

Now you can have a cartridge that you program as if it were computer RAM then acts as if it were ROM.

- ☐ Battery backed to last for upto 5 years (lithium battery). Simply load in the program and flick the switch. The cartridge can be removed and will retain the program just like ROM.
- ☐ Make autostart cartridges without the need for an EPROM burner.
- ☐ Can be switched on/off board from keyboard.
- ☐ 32K version offers 4 x 8K pages under software switching.
- ☐ Some knowledge of m/c is required but full instructions included.

DIGITAL SOUND SAMPLING

COMPLETE PACKAGE

£49.99 POST FREE

FREE AUDIO (TV LEAD!)

NOW FOR YOUR COMMODORE 64

The Datel Sampler now brings you this technology at a sensible price!

- • The Sampler allows you to record any sound digitally into memory and replay it instantly at any pitch, backwards, forwards, ascending scale, descending, with echo, reverb, flanging, endlessly looped etc. Truly professional hardware incorporating
- •Full 8 bit D and ADC conversion
- •Line or MIC input, line output and feedback control

A comprehensive software package including

- •A live effects menu with echo, reverb, digital delay, etc
- •Full sample editing facilities with review and on screen frequency plotting
- •A powerful real time sequencer

Copy Drum Software available separately at £9.99 to turn your sound sample into a Com-Drum system as well as a sampling system.

TURN YOUR MPS 801 INTO 4 PRINTERS IN ONE!

PRINTER IV ONLY POST FREE **£19.99**

Alternative character Rom fitted in minutes – no soldering required.

- • At the flick of a switch you can choose between any of 4 different superb new character sets.

DESCENDER • SCRIBE
ECLIPSE • FUTURE

Each set has true descenders.
All 4 sets can be mixed within one document.
Printer IV is a direct replacement for the normal printer ROM so it is 100% compatible with your existing software.
Graphics – No Problem either.
SEND NOW FOR QUICK DELIVERY

"For anyone who uses their printer often this chip is a must. It's quick and easy to use and the end results are impressive. YOUR COMMODORE Jan. '87."

IT'S BACK TOOLKIT IV

ONLY **£9.99** POST FREE

THE ULTIMATE DISK TOOLKIT FOR 1541/1540

Toolkit IV has, for some time, been generally recognised as the best disk toolkit available. The only problem for Datel was that it was distributed by someone else!! So when the opportunity to obtain the rights came our way, we jumped at it. And what's more, in keeping with our general pricing policy, we are offering it at less than half the previous selling price. A disk toolkit is an absolute must for the serious program hacker and TOOLKIT IV has more features than most for less:

DISK DOCTOR V2 – Read and write any track and sector including extra and renumbered tracks: Repair damaged sectors: Look underneath read errors.

HEADER/GAP EDITOR – Decodes and display: ALL header information including off bytes and header gap: Rewrite the entire header and header gap: Renumber sectors: Also edit any sector tail gap.

FAST DISK COPY – Copy an entire disk in 2 minutes or less using single 1541.

FAST FILE COPY – Selective file copy: Works at upto 6 times normal speed.

DISK LOOK – Sort directory: Recover lost files: Display file start/end addresses: Disassemble any file program directly from the disk to SCREEN or PRINTER including undocumented opcodes: Edit Bam: Much, much more.

FILE COMPACTOR – Can compact machine code programs by upto 50%: Saves disk space: Compacted programs run as normal.

FORMATTER – 10 second format an entire disk or format any individual track or half track 0 to 41: Redefine any of 30 parameters to create or recreate unique disk formats.

ERROR EDIT – Quickly find and recreate all read errors including extra and renumbered tracks or sectors and half tracks from 0 to 41: even recreates data under errors and allows you to redefine any necessary parameters.

PLUS DISK DRIVE SPEED TEST, DISK ERASE, DISK DRIVE RAM MONITOR, DISK LOG, BASIC COMPACTOR/UNCOMPACTOR, FILE MAKER + MUCH, MUCH MORE.

TOOLKIT IV is an absolute must for the serious disk hacker. It has all the routines tha the others have plus all the ones they don't . . . there is no better product available at any price . . . available now complete with comprehensive instructions.

IT'S A COMPLETE LIGHTPEN SYSTEM . . . IT'S AN ALL IN ONE ILLUSTRATOR/GRAPHICS PACKAGE.

IT'S BLAZING PADDLES ILLUSTRATOR

DEALER ENQUIRIES WELCOME

Complete with the DATEL LAZERWRITER — An Advanced Lightpen featuring state of the art fibre optic technology.

ONLY £24.99 POST FREE — TAPE OR DISK (PLEASE STATE WHICH)

Yes Blazing Paddles is one of America's top selling graphics packages. Fully Icon/Menu driven, comes complete with the Datel Lazerwriter – A lightpen featuring the latest polymer fibre optic cable and sensor for pin point accuracy of a calibre simply not possible with conventional system.... ....But that's not all – Blazing Paddles will also work with any standard input device including Joysticks, Touch Tablets, Paddles, Mice, Trackball and Professional Graphic Tablets

A SUPERB PACKAGE WITH ADVANCED FEATURES

- ☐ Advanced Colour Mixing to create over 200 textured hues
- ☐ Painting with a range of brushes ☐ Air Brush ☐ Ovals
- ☐ Rectangles ☐ Lines ☐ Rubberbanding ☐ Text Mode
- ☐ Fill ☐ Single Dot Mode ☐ Freehand Draw
- ☐ Shape Library ☐ Clear ☐ Printer Dump
- ☐ Hires Screens saved from Action Replay can be loaded and edited etc (Disk)

PLUS A zoom feature for single Pixel editing while viewing, the results at full scale. ☐ Powerful cut and paste facility, shapes can be picked up, moved around, repeated and saved. ☐ Full Load and Save feature for pictures, shapes and windows which are supplied.

If you think the Software you get with your Mouse/Graphtablet is a bit weak then you can buy Blazing Paddles Software alone. FOR ONLY **£12.99** TAPE OR DISK (PLEASE STATE)

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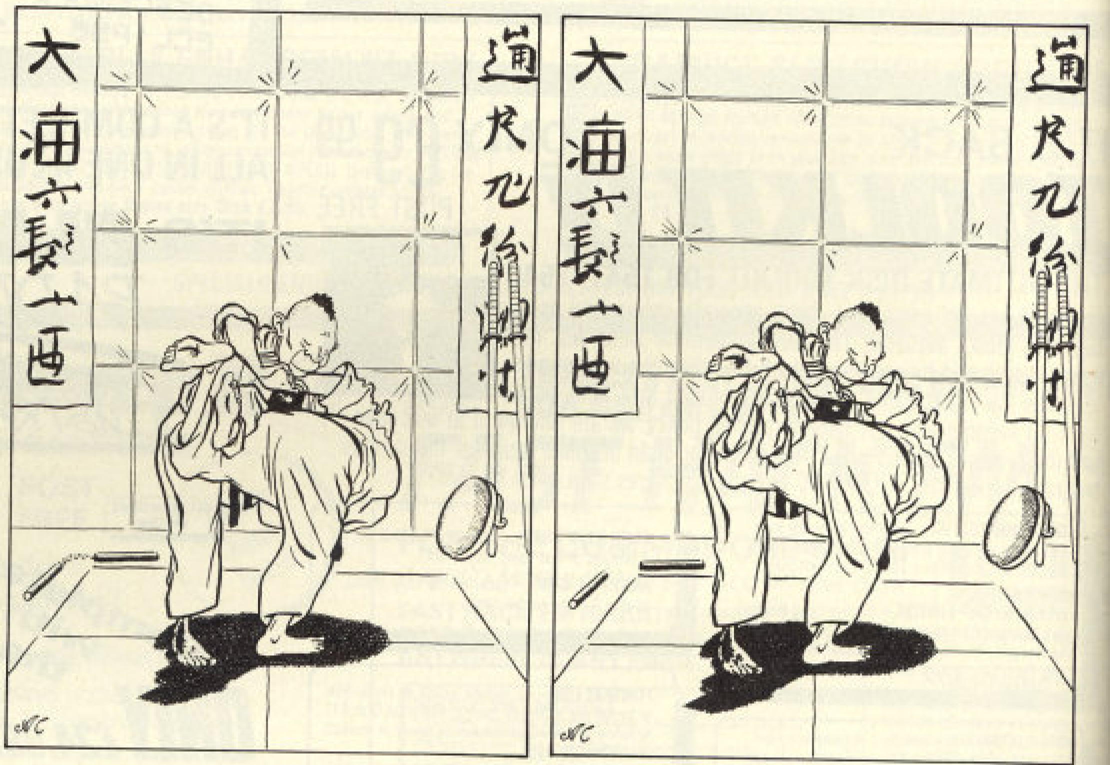
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Arcade Action

Hints, tips and programs to help in writing your own arcade games

By Tony Crowther

Producing your first arcade game need not be the difficult chore that many people believe it to be. All that is required is a good strong idea as to the basis of the game and an understanding of how all of the different parts are going to work.

In order to produce a quality game then it should of course be written in machine code. It is a lot harder to write a program in machine code than Basic, however, the increased speed of execution is essential to a good program.

It is outside the scope of this series to actually teach you about machine code. Should you be interested in learning then you could take a look at a series Welcome to the Machine that started in the March '86 issue of *Your Commodore* and finished in December, '86.

I am aware that many people will not be ready to tackle the rigours of machine code just yet. Don't let this put you off. Many good programs are written as a mixture of Basic and machine code.

During this series I will be presenting a series of small programs that you can use yourselves, either as part of a larger machine code program or simply called from within your own Basic program.

The series will be concentrating on programming with the C64, if you are a C16 or Plus/4 owner don't worry, whenever possible I will provide programs that will work on these machines.

What's to Come

So what will we be looking at? For a start I will be discussing the use of User Defined characters within your programs, how to use them and move them. Sprites will be dealt with in detail complete with routines to animate them and move them around your screen. Many games use backgrounds that are larger than the screen. The screen acts as a window over the larger playing area. I will be explaining how this is done and again provide routines to do this in your own programs.

A number of miscellaneous routines will also be provided for your use. These will include routines to scroll messages on the screen, print and increment scores, character editors, music programs and many more.

Presentation

Most of the programs that are presented in this series will be in machine code. I will be giving both the source code for the program and a Basic loader for those of you who don't want to tackle the assembler.

The assembly language programs have been produced using the Commodore Macro Assembler. I have tried to keep the assembly language as simple as possible so should you use a different assembler you should be able to enter the programs with very few changes.

Starting Out

In this month's article I am afraid that I am going to make you jump straight in at the deep end and deal with something that is extremely important

```
10 REM * C16 IRQ DEMO ROUTINE *
20 FOR A=818 TO 842:READ C:K=K+C
 : POKE A,C: NEXT
25 IF K<> 2577 THEN PRINT "ERROR
 IN DATA":STOP
30 DATA 120,169,63,141,20,3,169,
3,141,21,3,88,96
40 DATA 162,0,142,25,255,202,208
,250,76,14,206,0
50 PRINT"[DOWN][DOWN] SYS 818 TO
 START"
```

```
5 REM * C64 INTERRUPT DEMO ROUTI
NE *
10 BL=1    :LN=50    :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15:READ A:CX=CX+A:POKE SA+L*16+
D,A:NEXT D
30 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
40 NEXT L
50 DATA 120,169,13,141,20,3,169,
192,141,21,3,88,96,162,0,142,148
0
60 DATA 32,208,202,208,250,76,49
,234,5,0,0,0,0,0,0,0,1264
70 PRINT"[CLEAR][DOWN][DOWN][DOW
N]SYS 49152 TO START FOR C64"
```

FIGURE 1

to a games writer — interrupts.

In the coming months I will be going back to simpler subjects, however many examples that I will be giving will require a knowledge of interrupts and use the IRQ program that I am going to give this month.

Let Me Interrupt

So, just what is this thing that is so important to games writing? Well it's really as simple as its name suggests it is an interruption of whatever the computer is doing. Let me illustrate what I mean with a simple everyday example.

Let's suppose that you are having a conversation with someone and the telephone rings and interrupts your conversation. You leave the conversation and go and answer the telephone. If the call is for you then you would now hold a conversation with the person on the other end of the telephone. When you had finished you would put the telephone down and go back to and continue your original conversation.

What has happened is that the ringing of the telephone simply interrupts and paused your original conversation for a short while and you carried on where you left off upon returning.

So what about interrupts in programming?

Let's take a look at a practical example. If you were to write a program that required you to move a sprite across the screen you may write a routine that went along the following lines:

1. This is the main program.
2. The main program becomes interrupted by the routine that moves the sprite.
3. The sprite is moved by the routine.
4. Once the sprite has been moved we go back to step (1) and continue where we left off.

This is of course an over simplification but should give you an idea of what an interrupt can do.

Believe it or not your computer is actually being interrupted every 1/50th of a second by the computer's hardware. Everytime an interrupt occurs the computer takes a look at a memory location which holds information about where the interrupt program is stored. These couple of memory locations are referred to as the interrupt vector. In normal use whenever an interrupt occurs the interrupt vector holds the address of the general routines which look after the general running of the computer. These routines are items such as scanning the keyboard to see if a key has been pressed etc.

The interrupt vector is stored at the following memory locations:

788 and 789

These locations are the same on all the Commodore machines we are using.

So how do you use this in your own programs?

In Practice

Let's take a look at a practical example. Figure 1 gives a Basic loader for a machine code program that uses interrupts. Note there are two versions of the program one for the C64 and one for the Plus/4 and C16.

FIGURE 2

```
  10         ;************************
  20         ;* INTERRUPT / FLASHING *
  30         ;* BORDER DEMONSTRATION *
  40         ;* C64 VERSION *
  50         ;************************
  60         *=$C000                 ;WHERE PROGRAM STARTS IN MEMORY
  70 IRQVEC =$0314                   ;IRQ VECTOR
  80 BORCOL =$D020                   ;ADDRESS OF BORDER COLOUR
  90 NORIRQ =$EA31                   ;VALUE NORMALY STORED IN IRQ VECTOR
 100         ;
 110         ;THIS IS SECTION 1 THE SETUP ROUTINE
 120         ;
 130         SEI                     ;INTERRUPTS OFF
 140         LDA #PROG&255           ;POINT THE IRQ VECTOR
 150         STA IRQVEC              ;TO OUR NEW PROGRAM
 160         LDA #PROG/256
 170         STA IRQVEC+1
 180         CLI                     ;INTERRUPTS BACK ON
 190         RTS                     ;AND RETURN TO BASIC
 200         ;
 210         ;THIS IS SECTION 2 THE ACTUAL PROGRAM THAT CHANGES THE BO
RDER COLOUR
 220         ;
 230 PROG    LDX #$00
 240 LOOP    STX BORCOL              ;STORE X REGISTER IN BORDER COLOUR
 250         DEX
 260         BNE LOOP
 270         JMP NORIRQ              ;CONTINUE NORMAL IRQ PROGRAM
```

```
1000 REM C64 IRQ DATA BASE LOADE
R
2000 FORL=0TO9:CX=0:FORD=0TO15:R
EADA:CX=CX+A:POKE49152+L*16+D,A:
NEXTD
2010 READA:IFA<>CXTHENPRINT"ERRO
R IN LINE";2040+(L*10):STOP
2020 NEXTL:END
2040 DATA120,162,0,169,0,157,63,
3,232,224,192,144,248,162,0,169,
2045
2050 DATA0,170,157,0,157,157,0,1
58,157,0,159,232,208,244,169,81,
2049
2060 DATA157,88,192,169,192,157,
89,192,232,232,232,224,30,144,23
9,169,2738
2070 DATA0,141,14,220,169,82,141
,20,3,169,192,141,21,3,169,0,148
5
2080 DATA141,18,208,169,27,141,1
7,208,169,1,141,25,208,141,26,20
8,1848
2090 DATA88,96,169,1,141,25,208,
32,0,0,32,0,0,32,0,0,824
2100 DATA32,0,0,32,0,0,32,0,0,32
,0,0,32,0,0,32,192
2110 DATA0,0,32,0,0,76,49,234,12
0,169,49,141,20,3,169,234,1296
2120 DATA141,21,3,169,1,141,14,2
20,169,121,141,25,208,169,240,14
1,1924
2130 DATA26,208,88,96,255,255,25
5,255,255,255,255,255,255,255,25
5,255,3478
```

FIGURE 3

When you run this program it simply POKEs a short machine code routine into memory. To start this machine code routine simply type the SYS instruction which is printed by the program.

What this program does is to change the border colour every time an interrupt occurs. Because interrupts occur extremely quickly the flash rate is so high that the different colours appear as a number of flashing bands.

You may notice that the border is still flashing even though the computer has returned to the READY prompt. You can list any program that is in memory or even type in a new program and the border will continue to flash. This is because, as I stated earlier, the computer is always being interrupted every 1/50th of a second and our little screen flash routine is run every time an interrupt occurs.

The Machine Code

So let's have a look at our machine code program and have a look at what it does. Figure 2 gives the source code for the C64 version of the border flash routine. The C16 version is almost identical apart from the locations that are used to change the border colour.

The program is actually in two separate parts. The first section actually alters the IRQ vector so that it holds the location of our border flash routine, section two of our little demonstration.

Taking the program line by line this is what it does:

1. We turn off the interrupts with the SEI instruction. The reason for turning them off is quite simple. We are going to change the vector that is jumped to when an interrupt occurs. Since interrupts occur every 1/50th of a second, if we didn't switch off the interrupts then it is possible that an interrupt would occur before we had changed both memory locations. If this was the case then the computer would not jump to our routine but rather to some other location in memory and the computer would probably crash.

2. After turning off the interrupts we alter the IRQ vector so that it points to our border flash routine.

3. Now we turn the interrupts back on.

Of course the interrupt vector isn't changed until you execute this program with a SYS instruction.

Our border flash program is extremely simple, all it does is to load the X register with the number 0. This is then stored in the border colour location. The X register now has 1 subtracted from it. Note in machine code if you substract a 1 from a memory location that contains a 0 it will become 255. The program then loops around until the counter gets back to zero when it jumps to the normal interrupt routines – keyboard scanning etc.

By normal interrupt routines what I mean is that we jump to the routine that is normally executed when an interrupt occurs. In other words we jump to the routine whose address is stored in the IRQ vector when the computer is switched on.

Going further

I hope that the above demonstration and supporting text makes it a little clearer as to what an interrupt is. The interrupts we have been dealing with are hardware interrupts that are generated every 1/50th of a second.

There are other ways of generating interrupts, for example the raster interrupt which can cause an interrupt depending on the position of the raster on the TV screen. However, at this time we don't really need to go into the other types of interrupt as we will deal with them as required.

IRQ Database

As I have already stated we will be using interrupts quite frequently within this series. In order to make them easier to use with our numerous routines you will find in Figure 3 the Basic loader for a C64 machine code routine which I call IRQ DATABASE, Figure 4 has the source for this for those of you who want to follow it through and see how it works.

This program functions by setting up a 'data base' of switches which are used to turn each routine on and off.

Each routine will be allocated a position in the database and can be turned on and off by simply POKEing a 1 or 0 into the relevant location of the database. For example on the C64 should you enter:

POKE 839,1

then the Message Scroll routine will be enabled. Of course the Message Scroll routine needs to be present in memory and this will be printed in a later part of the series.

Next Month

Have you ever wondered how you get moving objects in programs? If any of you have seen either of my *Blagger* games then the moving conveyor belts and ladders are the type of things I mean. Well next month I will provide a routine that will allow you to perform this with ease in your own programs. YC

```
FIGURE 4
1000 ;********************************
1010 ;****    INTERRUPT BOOT      ****
1020 ;********************************
1030 ;
1040 ;HOW TO USE FROM M/C
1050 ;
1060 ;       JSR 49152   IRQ ON
1070 ;       JSR 49272   IRQ OFF
1080 ;
1090 ;
1100 ;HOW TO USE FROM BASIC
1110 ;
1120 ;       SYS 49152   IRQ ON
1130 ;       SYS 49272   IRQ OFF
1140 ;
1150 ;*********************************
1160 ;
1170 CINV = 788       ;INTERRUPT VECTOR
1180 CINOUT = 59953   ;64 IRQ ROUTINE
1190 DTBASE = 831     ;START OF DATA BASE
1200 REDRAS = 53266   ;RASTER POSITION
1210 RASCOM = 53265
1220 TIMERA = 56334   ;TIMER 'A'
1230 INTFLG = 53273
1240 IQMASK = 53274   ;INTERRUPT MASK
1250 * = 49152
1260 ;
1270 ;
1280 PROG1            ;SET UP ROUTINES
1290  SEI
1300  LDX #0          ;CLEAR DATA BASE
1310  LDA #0          ;BY PUTTING 0 INTO
1320 LOOP1            ;831-1023
1330  STA DTBASE,X
1340  INX
1350  CPX #192
1360  BCC LOOP1
1370  LDX #0          ;CHANGE NEXT
1380  LDA #0
1390  TAX
1400 LOOP6
1410  STA 40192,X
1420  STA 40448,X
1430  STA 40704,X
1440  INX
1450  BNE LOOP6
1460 LOOP2            ;PROGRAM TO
1470  LDA #<FRED      ;JSR FRED
1480  STA CHANGE+1,X
1490  LDA #>FRED
1500  STA CHANGE+2,X
1510  INX
1520  INX
1530  INX
1540  CPX #30
1550  BCC LOOP2
1560  LDA #0
1570  STA TIMERA      ;TIMER A OFF
1580  LDA #<PROG2     ;POINT IRQ VECTOR
1585
1590  STA CINV        ;TO PROG2
1600  LDA #>PROG2
1610  STA CINV+1
1620  LDA #0
1630  STA REDRAS
1640  LDA #27         ;CLEAR BIT 8
1650  STA RASCOM
1660  LDA #1
1670  STA INTFLG      ;TURN ON RASTER
1680  STA IQMASK      ;CONTROL
1690  CLI
1700 FRED
1710  RTS
1720  ;
1730  ;
1740 PROG2
1750  LDA #1
1760  STA INTFLG
1770 CHANGE
1780  JSR 0           ;THESE ARE TO BE
1790  JSR 0           ;RE-VECTORED
1800  JSR 0           ;WHEN THE DATABASE
1810  JSR 0           ;IS IN USE
1820  JSR 0
1830  JSR 0
1840  JSR 0
1850  JSR 0
1860  JSR 0
1870  JSR 0
1880  JMP CINOUT
1890 ;
1900 ;
1910 PROG3            ;BACK TO NORMAL
1920  SEI             ;TURN OFF INTERRUPT
1930  LDA #<CINOUT
1940  STA CINV
1950  LDA #>CINOUT
1960  STA CINV+1
1970  LDA #1
1980  STA TIMERA
1990  LDA #121
2000  STA INTFLG
2010  LDA #240
2020  STA IQMASK
2030  CLI
2040  RTS             ;YOUR IRQ'S NOW OFF
2050 .END
```

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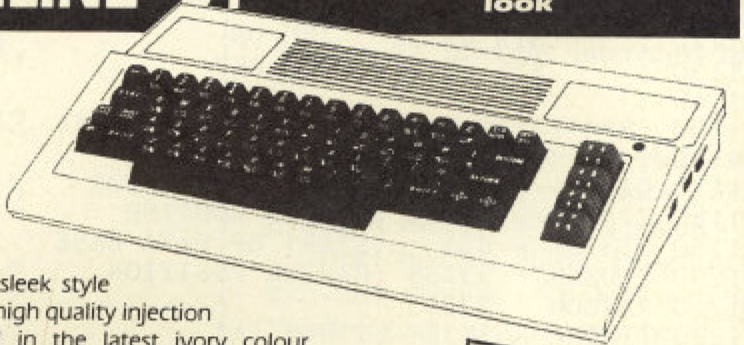
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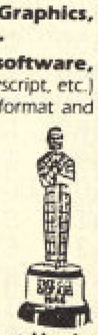
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Printmaster

Creat your own headed paper, greetings cards or other forms of stationary with this program from Ariolasoft.

By Evelyn Mills

Printmaster by Ariolasoft is a very extensive program with an overwhelming selection of options which, in my opinion, give it a very high rating in the operative field of creating your own graphics stationary. Performance is smooth, impeccable and the program is dedicated to the user in every respect.

On loading, the main menu gives the following options: Greeting Card, Sign, Stationary, Calendar, Banner, Graphic Editor and setup. The latter is for printer output options: while Printmaster (PM) is preset for the Commodore 1525/801, the printer output will allow conversion for Epson, Star, Okimate, Oki and C-Itan printers.

Editor

So what do we choose first from the main menu? I would suggest Graphics Editor to familiarise yourself with the graphics on the disk and also to experiment with creating your own graphics. Having highlighted this option, choose 'graphics by picture'... Here you will find 120 plus inbuilt graphics for your inspection and use!! Some of these graphics are relatively standard, a large proportion are very novel, but each and every one is very well designed for maximum graphic effect.

On display with your graphics, there is a side menu which allows you to edit, clear, invert, flip horizontally, flip vertically, save to disk or print (each graphic occupies three blocks on saving): inversion and flipping are shown very rapidly on screen. Editing and creating both have four functions controlled by F1 which handles drawing, shading, toggling and erasing. Drawing gives solid lines, shading gived dotted lines while toggling draws and erases where lines corss; the shading and toggling combination gives excellent 3D effects. All functions are joystick controlled, F1 setting the mode of operation for you.

Cards

Greeting Card: Here there are seven borders from which to choose, including a few unconventional ones such as 'crawling ants' – the programmers really enjoyed making this software. Eight fonts are available and there is space for seven lines of text (39 column width) so there is no need to stick to the usual conventional, cryptic greeting. Both upper case and lower case may be used. Naturally a graphics selection is available in either small, medium or large mode.

Now the program really gets interesting – you can stagger your graphics in a set manner or place them where you wish. At this point the function keys 1, 3, 5 and 7 interplay with one another. F1 positions writing to left centre or right; F3 alters size; F5 alters style while F7 alters the font. Effectively then, you may interchange positions and change fonts within any one graphic; should you overflow with enthusiasm, the screen will say so and it can be sorted out with the delete key. While you are still creating a Greetings Card, there is a Front Page and an Inside Page for you to use.

What have you done?

Now keep moving along (plenty of screen prompts) and you will be given the chance to PREVIEW what you have done. This, I think, is an excellent option. If you don't like what you have designed, back-step with the key and change it all. For a really radical change go back to the Main Menu and start all over again. If you like it – save the whole thing to disk for use at a later date (change a few names around when you reload if you wish) or print it out directly. Now who could ask for more than that?

The ↑ function is operative all through the program and allows you to back-step at any point for editing.

Making Signs

The SIGN Facility operates in a similar manner, and gives you a one page presentation with all the facilities described above including seven lines of entry.

Stationary naturally creates your own paper heading. Here the graphics may be to the left, to the right, 'tiled' or a row of tiles. Both the top and bottom of the page are programmable: note – the RESTORE Key stops printer output – so don't go too far away or you will have multiple pages at your feet. On the other hand, try half a page if you want!

What's the date?

The CALENDAR: very good is this: again chose your graphics, and font,

plus months and year. The 12 calendar months are listed and are selected by highlighting; the year is listed as 1986 which may be changed as directed; you are now asked for a monthly or weekly calendar.

The Monthly calendar selection gives the menu: continue, alter heading, and enhance date.

With 'alter heading' the font may be changed with F7 while the typed heading at the top may be altered with the delete key and input from the keyboard. Anyway assuming that you are quite happy with what you see, select 'enhance date': from this option you can now enter three lines of five characters each for any one date to remind you of who's who and what's what. Again you get a preview of your monthly calendar picture.

Yes, if you choose any particular year, the calendar will start on the correct day and date of that year. Leap Years? – of course they are catered for.

If you choose the weekly option you will then be asked for generic or specific options. The GENERIC format is not dated and the output is full screen with Sunday to Saturday of any one week (of any one month, of any one year) running downwards with blanked, lined spaces running transversely for you to write on at a later date (in pen, pencil or what not). The SPECIFIC format is similar but dated. Again you may have a preview before printout. The Calendar also supports graphics.

Long Notices

On to the BANNER which gives you graphics, fonts and one line of writing up to 39 characters long. This also used F7 for font changing thus allowing you to 'mix it up'.

All through the program upper and lower case may be used as can REVERSE MODE for both graphics and print. Fonts can be single, solid or 3D. The 3D effect can be a bit startling but what displeases my eye may well please yours.

Now if you cannot create with this program don't blame the back room boys. They have given you a disk full of powerful commands to implement plus excellent on screen instructions. The end result is very pleasing to the

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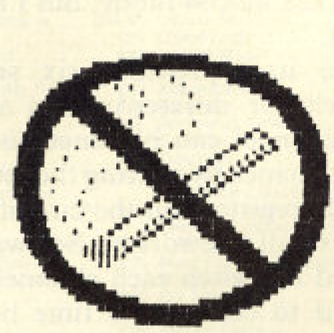
Computer

eye. The ability to back step, change fonts and words and preview your material before printing is an inspiration – plus the fact that, not only can you save graphics alone, you can save the whole card, calendar, banner or whatever. A five star epic. YC











Touchline
Name: ***Printshop*** *Price:* ***£29.94*** *Machine* ***C64*** *Supplier:* ***Ariolasoft, 68 Longacre, Covent Garden, London WC2 9JH*** *Tel:* ***(01) 836 3411.***

Percussion Section

Building add-ons for your computer sounds like a daunting task, however Maplins Computadrum makes it possible for amateurs.

By Neil Day

My friend who knows about such things said I was crazy to try, but I wanted to build something to add on to my C64. I think I found the ideal beginner's project in a cheap drum synthesizer kit from Maplins, a large electronics chain and mail order firm.

Computadrum is supplied as a packet of components with a printed circuit board. The kit will work with a number of different micros including the C64 and Vic 20. It should also work on a C128 in C64 mode, but I haven't tried it.

The unit provides six separate channels, or different drum sounds. Each channel can be tuned for pitch and resonance by altering the setting of variable registers on the circuit board with a small screwdriver. Software can be used to switch each channel on or off and to control the time between each beat. You might think this would give access to six sounds only. You'd be wrong. The six channels can be mixed in any combination. In effect, this gives you access to a large variety of sounds.

I'm told, by my friend who knows, that commercial drum synthesizers will do more, and the software provided is fancier. The *Computadrum* has one big advantage over these – you construct it yourself, and, in the process, learn a lot about the wonderful mysteries of the user port. That's what I now know to call the hole you can feel on the lefthand side of the back of your C64!

Signals, controlled by the computer, come from this port and are plugged into the *Computadrum* unit. Inside the unit these signals are used to generate the six drum sounds. The resulting signals emerge from a lead from the unit that has to be connected to the line-in or audio-in socket of an audio amplifier or monitor.

The packet supplied contains all but a box to house the unit and the leads. For the lead into the drum unit from the C64 computer you need a seven pin din plug, a couple of feet of seven way cable for the six lines plus ground, and a 24 way edge connector to plug into the computer. The output lead will depend on the type of amplifier or monitor or you are going to use. Most commonly a single RCA type plug is required. A very professional looking box to house the unit can be supplied by Maplins for about £5.60. Cheaper ones are available too, or you could probably improvise one.

If, like me, you have never previously assembled electronic equipment, you may start out feeling a bit apprehensive. However, the process is easy. Maplins has a little brochure called *Constructors Guide* (ref xh791). It costs just 25p and tells you how to identify resistors, capacitors and other such beasts. I used the magnifying glass out of my daughter's stamp collection to read the values off the tiny components. I noted the value (ohms for resistors and farads for capacitors) on to a scrap of paper and then wrapped up the components of the same value together in the paper. This meant that I did all the identification of components (probably the hardest thing of all for me) in one sweep.

Sticking the components into the printed circuit board reminds me of knitting to a pattern, except it's a lot easier than the fairisle sweater I laboured over for 18 months! Some items need to be orientated correctly so that the positive end goes through the correct hole in the PCB, but this is always indicated in the very clear lettering on the board itself.

You are advised to poke in a few components at a time, and then solder them into position. You use small wire-cutters to remove the excess wire, protruding from the bottom of the board, and repeat the process until all the components are installed.

The last time I used a soldering iron was to mend the spouting; that was harder than soldering the components in place. The detailed advice in the *Constructors' Guide* and the project instructions helped me here. Large lumps of blue tack secured the board, leaving two hands free for the soldering. The only items that were at all tricky were the semiconductors because the pins on these are very close together. The finer the point on your soldering iron the easier it is.

Well, putting it all together takes a few hours, but in the process you read the excellent instructions and get a general idea of what each circuit does. Before long you've soldered the leads and it's time to test the unit.

Mine didn't work! I checked both for whiskers of solder shorting the

tracks on the pcb and the correct placement of components. These were all OK. My mistake was that I had assumed that the wire marked "ground" from the user port would wind up attached to the metal shield round the seven pin plug at the end of the input cable. I was informed by my friend, who knows about these things, that only a person with the brain of a small gnat would do this but you still might appreciate the tip. The ground wire has to be connected to one of the seven pins. Mis-wiring the cable was the only construction error I made.

This fixed, I got some convincing drum sounds, but I couldn't work out which of the adjustable resistors altered which of the six voices. It turned out to be my misunderstanding of the short program you type in to run the drum. To turn a line on, or "set it high" as they say, you have to poke the appropriate value into register 56577: for instance binary %000001 turns on the first line and makes the first drum, called drum zero sound: binary %0000011 turns on lines zero and one making these two channels of the synthesizer sound simultaneously. My problem was that when the program asked me to type in the drum number, I assumed that five would give me drum number five and so on. But five is, in binary, %00000101, so it turns on drum zero and two together. In other words you must tell the program to poke in a denary equivalent of the binary value of the drum number. If you want drum three you need to type eight (2*2*2 or 2 to the power of 3). Similarly, drum four is indicated as 16, and drum five as 32 or two to the power of five.

All-in-all, building the Computadrum kit is very absorbing, and gives you a good understanding of how the computer can be used to control external equipment. Now I'm looking for a mail order DIY robot that will dance to the pulsating rhthym of my drum machine. He who knows about these things says I should get in touch with one of those seamier types of mail order places that sell a special type of inflatable robot. He says that what I did when wiring up the cable would stand me in good stead. You have to get used to opaque comments like this from electronics experts when you're an amateur hardware constructor!

Touchline
Comptadrum Construction Kit.
Reference: LK52G
Cost: £10.95

Constructors' Guide Pamphlet.
Reference: XH79L
Cost: 25p

Maplin Electronic Supplies Ltd
P.O. Box 3, Rayleigh, Essex, SS6 8LR.
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Everyone has probably faced this problem. When it does happen it's a matter of spending hours searching through the program for any typing mistakes. No matter how lo ng you look or how many people help you, you can usually guarantee that at least one little bug slips through unnoticed.

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

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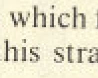
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The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format you will also find a couple of symbols after this strap. The symbols have the following meaning:



This symbol means that the program is available on cassette.



These programs are available on disk.

Please Note

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NOVEMBER 1986

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JANUARY 1987

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FEBRUARY 1987

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MARCH 1987

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Order codes
YC MAR 87
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Cassettes or disks are available back to March 1986. Please ring the Editorial office (01-437-0626) for details of these.

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Device One

A printer interface is one of the most important items you may ever buy. Device One could be just what you're looking for.

By Stuart Cooke

When Commodore launched its range of home computers, the need to purchase Commodore products in the future was virtually built in. Should you require a disk drive then you would have to use Commodore's. If you wanted a printer then you would have to use Commodore's. All this is due to the fact that the computers have a non-standard interface.

Most of the popular printers such as Epson, Star and Citizen come complete with a centronics interface making them unuseable with a Commodore computer. To solve this problem many parallel interfaces have been built that enable you to use a parallel printer with a Commodore though none of them have been as powerful as the *Device One* from Precision Software.

The purpose of *Device One* is basically to link together a printer with a parallel interface to the Commodore computer. The computer talks to the printer in the normal way i.e. it thinks it is talking to a Commodore printer while the interface makes the printer behave as though it is a Commodore printer.

The actual casing for the interface is made from what appears to be a Vic20 cartridge case. The only reservations that I have about the interface are partly due to this. Only part of the circuit board is covered and a large proportion of it is visible to the outside world. I can't help wondering if a metallic object such as a paper clip could find its way into the interface through this opening and cause havoc to the chips inside.

The interface itself contains 16K of RAM and 16K of ROM, there are four built in character fonts, so you can print listings in different faces. There is also the facility to print out in your own fonts, print pictures, calendars and banners.

Documentation

The manual accompanying the interface was printed using *Device One* and its different fonts showing the flexibility of the interface. The manual is extremely clear with many examples used to illustrate different functions.

Many of the different commands are extremely difficult to remember, even though the manual does make it extremely clear how to use them, the interface therefore has its own inbuilt documentation. Hold down the reset button on the interface for more than three seconds and a brief summary of the available commands will be printed out for you.

In Use

Setting up the interface is extremely simple. The interface plugs into the Commodore serial port and the printers centronics port. A third connection is made with a transformer to a convenient mains socket.

The interface will work with no less than 25 different types of printer, all of the popular types such as Epson etc. are available. Selection of the printer type is simply made by altering the position of three switches on the front of the interface. Other switches determine if you require an autoline feed and the mode of operation of the interface. There are four different modes of operation, 1525 emulation is, as its title suggests, total emulation of a Commodore 1525 printer, you also have access to all of the *Device One* features such as fonts and calendars.

Semi-transparent mode passes all commands directly to the printer without any conversion, however Device One commands will still work.

Transparent mode passes characters straight through to the printer, Device One commands will not work.

ASCII mode passes al codes straight through to the printer except for characters. Any characters are translated from Pet-ASCII to normal ASCII so that they are printed correctly on your printer.

1525 Emulation

When using this mode all of the Commodore printer commands such as double size work as you would expect. This means that you can now use any program that requires a Commodore printer without any problems at all.

Device One Control

There are no fewer than 32 different commands that can be sent to the *Device One* interface. Commands can be sent to the interface in one of two ways. Either you can open a channel to the printer with a secondary address of 15 e.g.

OPEN 4,4,15

or you can send two escape codes (27) to the interface before a command.

Obviously there are far too many commands available to go into them all so I will concentrate on the main ones.

Custom Fonts

One command will allow you to select the font that you would like to use. There are no fewer than six variations of this command and for many of them you must have down-loaded into the *Device One* the font that you require, note this is not the same as one of the four in-built fonts.

You can select a low-res font which

is made up of 6*8 dots. You may select a mid-res font which is made up of 8*8 dots. A hi-res font may be selected which is made up of 12*8 dots on an Epson type printer or 16*8 dots on some others.

One of the four in-built fonts may be selected, Figure 1 gives examples of each of these. You can select your printers normal font and Underline can be switched on or off.

Downloading

In order to get fonts etc. into the interface you must select one of the seveon download commands. Commands exist to download each of the different styles of font as well as each line of the picture is printed. Should you send text to the printer you could print this over an illustration.

Printing Calendars

There is an in-built calendar mode in the interface. This simply prints out a calendar for a specified month on your printer and can be printed in any font.

Banners

This mode will allow you to print any message sideways on to your printer, each letter of your message being as high as the width of the paper.

FIGURE 1

```
the quick brown fox jumped over the lazy dogs back.
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK.

the quick brown fox jumped over the lazy dogs back.
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK.

[illegible]
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK.

the quick brown fox jumped over the lazy dogs back.
THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK.
```

downloading a picture into the interface's RAM, sending a text file so that it is printed in transparent mode and downloading a disk drive to the printer. Downloading is extremely easy since once the interface is told to download it waits until you send it the necessary information. The easiest way to do this is to VERIFY the file that you require. This file isn't read into memory but is sent down the bus to the interface.

Printing Pictures

Pictures can be printed in either full-tone or half-tone. Full-tone simply means that the image is in black and white while half-tone means that the interface will use shading to print out the different colours. In order to print a picture it must be down-loaded into the RAM in the interface. Then each time the interface is told to print a line

Laying It Out

Commands exist within the interface to set the page length of the interface and the left and right margins. For anyone who uses a wordprocessor that doesn't have header and footer commands the inclusion of this in the interface will be a welcome addition. You could even use headers and footers to print messages at the top and bottom of any listings that you print out.

NLQ

Many people would love to have access to a daisy-wheel printer which prints extremely clear characters, however for most of us the price of these is far out of our reach and we are therefore stuck with the dotty products that our printers provide. The NLQ mode of the *Device One* does improve these dramatically by printing each character twice. This gives a more professional finish to any printouts.

Software

Not only does *Device One* come complete with its own built in software, it also comes complete with a disk full of it for the C64. The software included is:

Printerizer – This allows you to convert pictures from most of the popular packages to Device One format.
Font Editor – This allows you to create your own fonts for use with your printer.
Dump All – This patches into your machine and allows you to get a screen dump at any time by holding down a few keys.
Dump Text – Similar to the above but this only prints text.
Draw! – A simple drawing package that allows you to create your own hi-res pictures.
Print Utility – A program that makes printing calendars, banners or downloading pictures and fonts much easier.
Font Capture – This allows you to go through the memory of the computer so that you can capture any fonts that are used within your programs for use with your printer.

Verdict

Device One is the most powerful printer interface that I have come across for the Commodore range of machines.

The interface is easy to use and the manual is clear enough for even a novice computer owner to get to grips with the interface without any problems.

The interface is expensive but well worth saving your pennies for, and especially since there are interfaces in the market that don't do as much and cost more.

Touchline

Product: *Device One.*
Company: *Precision Software, 6 Park Terrace, Worcester Park, Surrey KT4 7JZ.* ***Tel:*** *01 330 7166.* ***Machine:*** *C64/128.*

CP/M and the Commodore128

CP/M, much neglected mode of the C128, is probably the most useful for the serious user. Here we examine the Commodore version of this phenomenon.

By Mycroftt Appleby

There are differences between the definitive CP/M and the Commodore implementation, however this article should enable you to understand just what these differences are, plus I hope to give you an idea of the more common transient programs supplied with the CP/M+ system.

The Commodore Connection

If you read my article in *Your Commodore*, March 1987, you should remember that, the CP/M system, as now defined, requires a Z80 processor, 64K, an 80 column screen and one or two disk drives. The CP/M+ system, supplied with the C128, assumes 128K.

In the Commodore implementation there are a couple of changes made to this initial specification. The screen can be in either 40 or 80 column mode and, as most people can only have one disk drive, there is a software mechanism for treating it as two separate drives to make copying and various disk functions easier.

This is achieved through the use of drive 'E'. Normally to copy between two disks you need two drives, for instance 'A' and 'B'. The computer takes the information off drive A and puts it on to drive B. That works fine for dual drive systems, but most Commodores only have one drive, which makes things rather difficult. So Commodore came up with the drive 'E' system. Specifying a copy between drives A and E is like a single disk copy with drive A refering to the original and E refering to the copy. Although, you can do it the other way around. The main point is that drive E doesn't exist. Only in the minds of the system's programmer and everybody knows that most systems programmers are deranged anyway. This system is very good and simple to use and is a brilliant way around a rather tricky problem. It's much more usual for Commodore to leave something like that for the user to sort out.

On Screen

The other anomaly in the Commodore CP/M system is the ability to use a 40 column screen. This is for the legions of C128 owners who have no 80 column monitor but just one of the old composite colour monitors or TVs. It operates by having a 40 column window on a logical 80 column screen. Everybody must recognise this from a large number of wordprocessors that run on the C64. This is probably the most ideal solution and the only real way to get some of the software working. This said, it is probably better to find a cheap green screen monitor and use that instead. There are some very good ones nowadays for around £80 and it is worth the investment if you are going to use CP/M for any length of time.

Though CP/M+ was designed to have a certain amount of room in the OS for graphical links, CP/M 2.2 – the operating version that most CP/M programs were written under – has none. So most CP/M programs are in monochrome anyway. Other than that you are best sticking to software that will run under 40 column CP/M like languages or programs written for the old C64 version of CP/M 2.2.

On the Record

The other difference that is inherent in all CP/M systems is the disk format. The disk format is the way that the disk controller tells the disk drive to write to the disk. As most people know, the process of writing to a disk is very similar to that of writing to tape. To take the analogy further, there are different ways of writing to tape and two distinct writing systems. One is 'Helical Scanning' as used in video recorders and the new Digital Audio Tape (DAT) system. This is incredibly complex and is beyond the scope of this article. The other method is the straight linear recording system.

Using this method, a certain amount of tape will pass the tape head in a certain amount of time. In that time a certain amount of data will be written to the head. There can also be between one and nine tracks on the head. Now as we know, different computers have different methods of writing data to tape, on tape this is known as the tape format. But, on disk it is known as the sector format. Also, the way in which the head writes to the tape is different, effectively how the varying magnetic field of the head affects the tape.

All these differences also apply to disks. The amount of data packed on to a linear of a disk is called the sector density and can vary between five and 10 for CP/M disks or 16 and 22 for Commodore disks. The number of tracks on a disk can vary between 35,40, and 80. There are three main ways of writing data to the disk FM, MFM, and Commodore GCR. And there are one or two other differences as well.

So, now you see that there are a lot of differences between disks, even

though they are the same size (imagine poor old Amstrad users who even use different types of disks!) the C128 *has* to be able to read many formats as possible to be able to make the best use of CP/M. To do this a novel solution was found.

The Solution

In the past, Commodore computers used 35 (or 77 for older machines) tract, GCR, 22 to 16 sectors per track and 256 bytes per sector. This format was designed from the start to be reliable, fast, and make the best possible use of disk space. And indeed the figure of 180K for a single aided, single density, 35 track disk has never been beaten. However, the rest of the world started with very low density disk drives and could only modify their system as the hardware got better.

As you can see, there is no way on earth that an old Commodore drive can read the more standard type of disk. So all you people with 1541s – hard luck. You can use Commodore specific CP/M programs (and there are quite a few available from ICPUG) but you won't be able to access any of the generic CP/M stuff.

No, to read CP/M generic disks you need to have either a 1570 or 1571. The difference between the two is that the 1571 will read and write to both sides of the disk and the 1570 is only a single sided drive. What this means is whilst you *could* read some CP/M disks in the single sided drive, you may have to get them specially written or only be able to read half the information. So get a 1571, this is the same drive as the one that is fitted internally into the C128D.

The 1571 is 40 track double sided, is capable of FM, MFM, or GCR, and can hold 200K, 400K, or 368K. This last mode is the double sided Commodore GCR format and is only really used by the C128 in Commodore Basic mode and when booting CPM. 200K is available in FM or *single density* mode and the 400K mode is MFM or *double density* mode. These two modes could make the C128 read 90% of all CP/M 2.2 disks ever written, but instead, the most popular nine are provided. This still covers the vast majority of CP/M disks, they are:

IBM 8 sector SS
IBM 9 sector SS
KayPro II
Osborne SS
IBM 8 sector DS
IBM 9 sector DS
KayPro IV
Osborne DS
Epson QX 10

The first four formats can be read by the 1570, all formats can be read by the 1571. It is interesting to note that the IBM 9 sector DS is the same format as used by IBM compatibles when using CPM-86. This was the Digital Research answer to MS-DOS that never really took off. However, many IBM compatibles retain the ability to read or write disks in this format and so *data only* transfers are possible. Another side point is that the Amstrad CP/M machines (CPC 464 with disks and CPC 664) and CP/M+ machines (CPC 6128, PCW 8256, PCW 8512) can read and write disks in this format.

Transient Commands and Friends

Last month I explained the concept and purpose of the transient commands along with some of the simpler ones that are only really extensions of the inbuilt or *resident* commands. After these come the utility programs that can either be considered as transient commands or as programs in their own right. They are usually used as commands when only one operation is needed, whilst for multiple operation the stand alone program mode is more useful.

The most commonly used, and indeed one of the most useful commands is known by the incredibly informative name of PIP. PIP stands for Peripheral Interchange Program, and has been called 'the most powerful command ever written'. This uses the definition of power that derives from making a lot happen from the fewest keystrokes possible. However, this is more to do with PIPs convoluted shorthand system than anything else. Effectively, what PIP does is to transfer a file from one device, perform some action on the file (or not as the case may be) and transfer it to another device.

This command is exceedingly useful, has to be included on the systems disk, and is rarely even documented in CP/M instructions supplied with any CP/M machine. So here is the minimum you will have to know to get it going.

PIPped at the Post

As mentioned earlier PIP is used to transfer files around. The transient way of using PIP is to be typed 'PIP xxx' where 'xxx' is the function that you want to happen. When this is completed or an error occurs you will then drop into the C/PM system prompt (A >). The programmed method of using PIP is just to type 'PIP' on its own. You then get the PIP prompt which is an asterisk (*5*) followed by the cursor. To use the earlier example, if you typed 'xxx' after this prompt it will be acted upon. The difference is that after it is finished or a recoverable error condition occurs, you will drop back into the '*5*' prompt ready for another command.

The format for the PIP instructions (I will assume from now on that all instruction are following the '*5*' prompt) is 'target becomes source operation'. Either the target or the source can be either a file name or a device and the operations will be detailed later. The file names can support all the wildcards and drive designations that the more complex transient commands have. So the most simple example of the PIP command is the disk copy 'a:*.* = b:*.*' will copy the contents of drive 'B' on to drive 'A'. Single files, and groups of files can be copied or even renamed; 'fred.txt = bill.txt' will change the text file 'bill' into the text file 'fred'.

The main use of PIP is to transfer information between devices. 'temp.txt=con:' will accept input from the keyboard and creat a quick text fild. 'LPT:=text.txt' will print out the text file and something like 'BBC.tmp=ios:' will read information from the serial port (perhaps from another computer) and create a file with it.

However, the most powerful function that PIP has is the operations at the end of each instruction. The examples above will do the transfer with no change in the file being transfered. However, the inclusion of a few letters after the instrucion in square brackets can change everything.

Z :This zeroes the parity bit (bit 7) in ASCII files.

W Overwrite, this will

ignore the read-only (RO) attribute.

V :Verify transfer. This will check the transfer to see that it's OK. Useful in disk copying.

U :Converts to upper case all lower case letters.

Tx :Expands all tab characters (Ctl-I) found in the file to whatever the value of 'x' is.

S$ ^ z :Starts the transfer of the file at the designated string '$'. The string is ended with a Ctl-Z.

R :Ignores the SYS attribute when reading files.

Q$ ^ z :Similar to 'S' but stops copying at the specified string.

Px :Inserts a form feed character (ASCII 12) every 'x' lines, defaults to 60.

O :Object file copy. Use this for transfering non-COM non-ASCII files.

N :Adds line numbers to the start of each line. 'N2' will insert a Tab character after each number and kill all leading zeroes.

L :Converts all capitals to lower case.

H :Use for transfering Hex files.

Gx :Reads file from User Area 'x'.

F :Removes all from feeds.

E :Echoes all data transfered to the screen.

Dx :Traunicates all lines to 'x' columns long.

B :Buffer transfer. Reads all of file into a buffer until end of file or Ctl-S (stop) character is received. Useful for reading from RS232 or using drive 'E'.

All these operations can be compounded, so 'PIP a:=b:*.*[VG6ER]' is pefectely valid. The only problem with PIP is that it is a little convulated to use, you finde that there are usually programs on system disks that will do some of the functions of PIP (like copier programs for instance) with a little more regard for user friendliness, but none of them have the power and versatility that PIP can provide if it is understood properly.

Next Month

In the next issue, I shall reveal how some of the stranger CPM commands work and start to explain some of the utility programs. Also there will be a quick overview of the Commodore 64 CP/M 2.2 system and how it relates to the modern Commodore CP/M philosophy.

For everybody that is getting impatient to use batch processing (i.e. tell it to do half a dozen things and then leave it alone to get on with it whilst you watch 'EastEnders') or how to actually program the thing, all will be revealed later. YC

Keypad Modifier

Now you can use your numeric keypad to type in lists of data statements.

By Mahmood Hassan Merchant

The Commodore 128 comes with an excellent keyboard which is complemented by a numeric keypad situated on the right. At first glance this would brighten any programmer's heart. You could be mistaken for thinking that it can be used for keying in data statements. But, on more careful examination, it becomes clear that the keypad has been primarily designed for accounting data entry with '+', '-' and '.'-keys. Normal Basic data statements cannot be entered with it. Or can't they?

I realised, that with a little effort, the keypad could be redefined to meet this need. Hence the birth of the Keypad Modifier.

Purpose

This is a machine language utility which resides at the unused RAM at 5000. This start location is defined in line 40 as variable AD. The value of this can be changed if required and a working version of the program will be POKEd to that location and onwards.

The program redefines the '+' key as DEL. This is useful when you make a mistake in your data statements. The '+' key is located on the top right of the keypad just like the DEL key on the normal keyboard, and this makes it very convenient to use.

The '-' key, when depressed, prints the word DATA on the screen. The comma, required to separate the numbers in a data statement, is now available using the '.' key. The number and ENTER (or RETURN) keys act as usual.

Hints on Loading

The Basic loader accompanying the program POKES the data. If you own a disk drive, the loader will generate a binary file with the name you specify. Later, whenever you want to use this utility, just enter: BOOT "FILENAME" to load and activate the modifier.

Tape owners can enter the built-in MONITOR and save the machine code with: S"FILENAME",01+5000,+5067. The machine code can then be loaded with: LOAD "filename",1,1. You should then type NEW and SYS 5000 to activate.

In Use

The best way to use this utility is to first use the AUTO feature of Basic. Type in the first line number and press space. Now you can forget the main keyboard. Just press the '-' at the beginning of a new line, the number of which will be automatically printed if you are using AUTO. Then enter the numbers pressing '.' to separate them and press ENTER to enter the line. If you make a mistake press '+' to delete. YC

PROGRAM: 128 KEYPAD MOD

```
10 PRINT"[CLEAR]      128 KEYP
AD MODIFIER"
20 PRINT"[DOWN](-)  PRINTS 'D
ATA'":PRINT"(+)  DELETES CHAR
ACTERS"
30 PRINT"(.)  PRINTS COMMA"
40 AD=5000:FORI=0TO66:READA:X
=X+A:POKEI+AD,A:NEXT
45 H=INT(AD/256):L=AD-256*H:P
OKEAD+2,L+13:POKEAD+7,H
50 IFX<>8476THENPRINT"ERROR I
N DATA STATEMENTS":STOP
55 INPUT"TAPE OR DISK (T/D)";
Q$:IFQ$="T"GOTO80
60 INPUT"NAME FOR BINARY FILE
";F$:BSAVE(F$),B0,P(AD)TOP(AD
+67)
70 PRINT"TYPE: BOOT"+CHR$(34)
+F$+CHR$(34)+"  TO LOAD AND A
CTIVATE":END
80 PRINT"SYS"AD" TO ACTIVATE"
:END
100 DATA 120,169,149,141,60,3
,169,19
110 DATA 141,61,3,88,96,201,4
6,240
120 DATA 11,201,43,240,11,201
,45,240
130 DATA 11,76,173,198,169,44
,208,249
140 DATA 169,20,208,245,166,2
08,169,68
150 DATA 157,74,3,232,169,65,
157,74
160 DATA 3,232,169,84,157,74,
3,232
170 DATA 169,65,157,74,3,232,
134,208
180 DATA 76,196,198
```

Go FORTH &*

Tired of your old programming language? Want to try something new and exciting? Then it's about time you checked out FORTH.

By Allen Webb

The title of this first article may at first appear odd but it is, in fact, a motto used by the FORTH Interest Group (FIG) meaning "Go FORTH and multiply". What I intend to do is propose some arguments in favour of the use of FORTH as **the** alternative programming language.

Basic Disadvantages

The majority of Commodore users are probably programming in Basic. Whilst Basic adequately fulfils its original function as an aid to teaching programming, it has serious drawbacks which hinder its use for serious applications:

i) Basic lacks the structural constructs which ease the creation of logical and easily understood programs. If you've evr tried to understand, alter or debug a Basic program written by someone else, you'll know what I mean.
ii) Being an interpreted language, Basic is both slow and uses memory inefficiently.
iii) Basic is inflexible.

Two important points must be emphasised. First, the enhanced Basics available to BBC and IBM clone owners are more efficient to use but are obviously machine dependent. If you want to have a program which is transportable to other machines, forget it. Secondly, you can get compilers which will speed up routines and save space. They do not, however, make the job of programming easier.

For all these reasons, many people will eventually become dissatisfied with Basic and will seek an alternative. Those interested in arcade games will generally choose machine code. Those, however, who do not seek the highest speed execution will want an alternative high level language. For the C64/C128, the alternatives are limited to PASCAL and FORTH. Those of you who own an Amiga will also have the option of C.PASCAL (and its derivative MODULA) is a powerful and well structured language but for power, structure, speed and elegance, FORTH takes some beating.

Forth Advantages

I do not intend to describe the FORTH language in detail since the books listed later will do the job better than I can. Instead, I want to discuss the

Listing 1

```
HEX
DO21 CONSTANT SCREEN-COL-REG

:COLOURCHANGE
            1 SCREEN-COL-REG     +! ;
: FLASH FF 0
            DO
                  COLOURCHANGE
            LOOP ;
: MESSAGE FF 0
            DO
            .     "FORTH RULES OK" FLASH
            LOOP   :
DECIMAL
```

FORTH philosophy and hopefully whet your appetite.

The main difference between FORTH and other languages is its approach to defining instructions or words. In Basic, instructions such as MID$, 3, PRINT etc. have fixed and clearly specified functions or meanings. Whilst FORTH uses a vocabulary of basic words (primitives), they are completely flexible and may be changed at will. If, for example, you want the instruction 3 to really represent 11, it is a trivial matter to make the change. This ability to define your own words and add them to the vocabulary gives programming an added dimension. It also makes the creation and use of Procedures both primitive and awkward.

Consider the example in Listing 1.

Here I have defined three words, COLOURCHANGE, FLASH and MESSAGE. Each definition is held in the section between the : and ;. COLOURCHANGE increments the screen colour (in $D021) by one. FLASH uses a loop to increment the screen colour 255 times. MESSAGE uses the flashing screen effect in conjuction with a printed message to give a nasty effect. The three words are added to the vocabulary and can be used in any subsequent words. In other words, a completely user defineable language.

If this flexibility wasn't enough, FORTH offers a combination of interpretor and compiler. When you write the program, you are in fact creating some form of text file using an editor. When any word is to be executed, the text is compiled. Since the primitives are efficiently defined in terms of simple machine code jumps, the compiled words are converted to a simple linked list of machine code instructions. This results in compact code which executes quickly.

Inside FORTH

Originally, FORTH was written using virtual memory held on disk. To do this, text is held in a series of screens each comprising of 1024 bytes. Within these screens, the text can be laid out in almost any format allowing the use of indenting and other tricks to give a well structured format as shown in Listing 1. Since many C64 users don't own a disk drive, many FORTHS use a RAM-disk approach to storing screens. Whilst the software is different, the perceived mode of operation is unchanged. This system of text input is extremely satisfying since the use of virtual memory on disk presents no penalty for using explanatory comments. Listing 3 shows what can be done.

In terms of capabilities, standard FORTH offers all of the structure you could ask for. The standard constructs are:

DO.....LOOP
IF...ELSE...THEN
BEGIN.....UNTIL
BEGIN.....WHILE.....REPEAT

CASE is not standard but can be easily implemented. Using such constructs with the unique "word" system, it is remarkably easy to develop a linear approach to programming without recourse to unsatisfactory constructs such as GOTO. In addition, the ability to nest words is conductive to the analysis of a problem by use of top-down design.

Here are a couple of further examples. Listing 2 shows a routine for the calculation of the factorial of a number. The routine is recursive in that it calls itself via the word MYSELF.

Much of the speed and power of FORTH derives from its use of a stack to hold values currently in use. Not only does the stack allow the rapid manipulation of data, but values can be easily passed to words. The word DUP in Listing 2 is used to duplicate the value at the top of the stack. The functioning of the routine is as follows:

1. The routine is entered with the number on the top of the stack.
2. It is duplicated to preserve it and it is decremented.
3. If the number is greater than one, the routine calls itself.
4. If the number is equal to one, the results of each call itself are multiplied together.

You might find it interesting to compare Basic routine to do the job to Listing 2.

Listing 3 also uses recursion. Can you sort out what it does?

Listing 4 gives a final example. This time I have a real application. Three example screens are shown for a music system on a Tandy TRS-80 Mk 1 using an AY-3-8910. Don't try to understand how it works – simply consider how neat the lay out is and how unlike a normal program it is. The use of normal English gives a user-friendly program which is easily altered by another user.

Listing 2

```
: FACTORIAL (n -- factorial)
        DUP 1- IF
              DUP 1- MYSELF *
        THEN     ;
```

Listing 3

```
: TEST (n -- n)
        2DUP<
        IF
              SWAP MYSELF
        ELSE
              DUP O=
              IF
                 DROP
              ELSE
                   SWAP OVER MOD MYSELF
              THEN
     THEN ;
```

```
Listing 4

Screen 1

(Words for AY-3-8910 Programmable Sound Generator)

VOCABULARY MUSIC  MUSIC DEFINITIONS  BLK @ 2- LOAD ( PSG Words)

VARIABLE TEMPO         70 TEMPO !
: ON     254 7 >PSG ;   : VOLUME    8>PSG ;   3 VOLUME

: FREQ  CREATE ,     DOES> @ 256 /MOD
                     0  ( flag for use by DOTTED ) ;

: DOTTED   NOT ;   (DOTTED changes flag value left by a note )

1499 FREQ C0     1415 FREQ C#0     1335 FREQ D0
1260 FREQ Eb0    1190 FREQ E0      1123 FREQ F0
1060 FREQ F#0    1000 FREQ G0       944 FREQ Ab1
891  FREQ A1      841 FREQ Bb1      794 FREQ B1
749  FREQ C1      708 FREQ C#1      667 FREQ D1
630  FREQ Eb1     594 FREQ E1       561 FREQ F1
529  FREQ F#1     500 FREQ G1       471 FREQ Ab2
445  FREQ A2      420 FREQ B2       396 FREQ B2
```

What's Avaliable

So you've had the sales pitch and you're lusting to start hacking in FORTH.There remains the question as to what is available.

First, there is the software. The first point to make is that FORTH users are a sensible lot when it comes to making systems available and it should be a simple matter to get hold of a public domain system. Try contacting the FORTH Interest Group. Alternatively, there are a few systems which can be obtained for cash.

Probably the most powerful system is *White Lightening* from Oasis. This was marketed as a games package and consequently offers a large number of graphics extensions. Both virtual memory on disk and RAM disk versions are available. Highly recommended.

Melbourne House publishes Abersoft's *FIG FORTH* for the 64. This offers some graphics extensions but is otherwise quite standard. Although it is simple to transfer it to disk, only RAM-disk is supported.

ROMIK (now defunct) offers no frills FORTH. This is quite a decent version and, if you shop around, you may pick it up cheap.

There are also versions from MPE and FORTHWITH but I have not evaluated either.

If you're really cool, trendy and lucky, you might be able to pick up a Jupiter Ace. For you who haven't heard of it, the Jupiter Ace was a FORTH based micro rather in the mould of the ZX81 (try Boldfield Ltd Computing).

Unfortunately, the instructions with most low cost FORTHs are poor and must be supplimented by bookware. The range of books is wide (the FORTH Interest Group has a bibliography) but two are worthy of comment. Both are by the same author, Leo Brodie: *Starting FORTH*, Prentice Hall, ISBN 0-12-842922-7; *Thinking FORTH*, Prentice Hall, ISBN 0-13-917568-7.

Both are worthy additions to any serious computer user's library and cater for users of all abilities.

I hope you have found this brief summary of FORTH of value. Unlike many languages, FORTH has the power and flexibility to grow with your own abilities and provide an effective and elegant solution to your programming programs. YC

Touchline

Boldfield Ltd Computing: *Sussex House, Hobson St, Cambridge.*
FORTH Interest Group: *Collins Walls, 54 Wild Briar, Wokingham, Berks RC11 4UL.*
FORTHWITH: *51 Rooley Moor Rd, Rochdale, Lancashire OL12 7AX.*
Microprocessor Engineering Ltd, *21 Hanley Road, Shirley, Southampton SO1 5AP.*
Melbourne House: *High Street, Hampton Wick, Kingston-upon-Thames, Surrey KT1 4DB.*
Oasis Software: *12 Walliscote Rd, Weston-Super-Mare, Avon BS23 1UG.*

```
Screen 2

(Music Vocabulary )

: NOTE   CREATE  ,
         DOES>    @ TEMPO @ *  (basic note duration )
                  SWAP IF 3 2 */ THEN >R ( adjust if dotted )
         1 >PSG 0 >PSG ON
         R> 0 DO LOOP  OFF
         10 0 DO LOOP           ;

256 NOTE BREVE              128 NOTE SEMI-BREVE
 64 NOTE MINIM               32 NOTE CROTCHET
 16 NOTE QUAVER               8 NOTE SEMI-QUAVER
  4 NOTE SEMI-DEMI-QUAVER 2 NOTE SEMI-DEMI-SEMI-QUAVER

100 TEMPO !

Bb2 DOTTED QUAVER          C2 SEMI-QUAVER
Bb2 QUAVER                 Ab2 QUAVER
G1  QUAVER  Ab2 QUAVER     Bb2 CROTCHET
F1  QUAVER  G1  QUAVER     Ab2 CROTCHET
G1  QUAVER  Ab2 QUAVER     Bb2 CROTCHET
Bb2 DOTTED QUAVER  C2  SEMI-QUAVER
Bb2 DOTTED QUAVER  C2  SEMI-QUAVER
Bb2 QUAVER            Ab2 QUAVER
G1  QUAVER  Ab2 QUAVER  Bb2 CROTCHET
F1 CROTCHET Bb2 CROTCHET
G1 QUAVER   Eb1 QUAVER       ;
```

Expanding Systems

Many people who bought the Commodore Sound Expander may have found it too much for their novice status. Perhaps this Music Sales Composer Editor will help.

By S.J. Chance

Did you buy a Commodore *FM Sound Expander* Package earlier this year? Did you thrill to the Country Banjos riff and Telstar demonstration? Did you then find that your key-board talents, no matter how great, would not allow you to produce anything sounding half as good as what the machine could play on its own? Dis-illusioned, did you give up your Learn to Play Keyboards course, and leave your £150 investment gathering dust under your bed? If you have answered 'yes' to any of the above questions, then hear the good news: the long awaited *Composer/Editor* software for the *Sound Expander* has arrived, and even at the slightly painful price of £24.95, it's a must.

At the time of writing, only the disk version was available, and that only with a photo-copy of the instruction manual, but a cassette version should be with us soon.

The Composer

The disk contains two separate programs: the FM Composer and the FM Sound Editor. I will deal with the Compower first. This allows you to enter standard music notation on to a double stave, over nine channels. The notes can be input from the external five-octave keyboard, nothing new to MIDI fanatics, but to those of us who have struggled up through *Ulti-Synth, The Music Studio, The Sound System,* etc., this is a new experience in terms of ease and speed.

Of course, if you don't have the external keyboard, notes can be entered fromt he computer keyboard, though this is a much more cumber-some way of doing things. Having the computer keyboard operating as a music keyboard does mean that a lot of other functions are relegated to the remaining keys.

Dotted notes, ties, triplets, dynamics, variations in tempo, all are supported by the program, but they are entered via a system of using the function keys to scroll through the options, which I found irritatingly clumsy.

Another minor gripe is that to move the cursor fromt he beginning of a music-file to the end involves it lurching its way through all the music in between which, with a piece of any length, can take a couple of minutes. The thing to do here is to break the music down into smaller sections with the 'sequence' option.

Repeats in the music are supported, including repeats with different endings, which enables one to make optimum use of memory space, not that the program doesn't leave plenty of RAM available.

Once entered, your music can be saved (only to disk from the disk version), edited, and dumped to a Printer. The Print-out is more readable than some, and doesn't have the problem of over-lapping quavers appearing to be semi-quavers which occurs with *The Music Studio.*

The music can be played back, in whole or in part, at any stage, and in any of 64 different voices.

The Editor

Moving on to the Sound Editor, this does exactly what it says it does. The sounds from the existing library can be altered, or new ones created. There are quite a few parameters to muck about with, and you don't have to have a clue what you are doing to get some interesting results. If you are short on inspiration, there is also a Fruit Machine option which sets-up the Parameters at random.

The sounds can be played from the external keyboard, and it is possible to set a keyboard-split, in a similar way as with the original Sound Expander Package. There are also two extra sets of voices which were omitted from the cassette version of the original Sound Expander software.

Also within the editor porgram is a crude drum machine, using five drums over 32 program steps. This is not as sophisticated in sound or pro-gramming as dedicated drum machine add-ons, but is quite respectable nonetheless.

Both the Composer and Editor are MIDI compatible through a relevant interface. If reading about MIDI has given you a headache in the past, using both these programs with the Sound Expander may well open your ears, and eventually your wallet, to the potential that MIDI provides. YC

Letter Writer

If you write a lot of letters and get fed up of using boring paper and pen, try this novel way to communicate with fellow C64 owners.

By Les Allan

This routine provides a novel way to send a letter, or indeed any form of communication, to a friend or fellow 64 user by providing a musical accompaniment to a tele-text type format.

Using the Program

Simply type in your letter from the keyboard using all normal print commands to make alterations or emphasis parts of text in different text colours. In fact by experimentation quite pleasing results can be achieved; the routine can also be used to draw or provide simple animation sequences.

When you are quite satisfied with the finished product hit the F1 key twice to initiate the save process. This relocates the text, music and m/c routine to start of Basic with a relocation program to save a single file of 39 blocks in length.

The program works with either disk or tape; the device being selected by monitoring the current contents of $BA.

The program can be further compacted by TURBO CRUNCHing.

The maximum text length is restricted to 4096 which provides sufficient room for most applications.

The program must be typed in exactly as listed and saved prior to running. Error trap routines are included to ensure that the data as read is correct. The program when run stores the relevant code at a temporary address of $8000 and when prompted relocates the working program to basic ($0801) and saves the program to disk.

```
PROGRAM: LETTER BOOT
55  10 M1=32768:M2=40096:CH=0
97  11 PRINTCHR$(144)CHR$(147)
C8  12 POKE52,120:POKE56,120:POKE
    53280,15:POKE53281,12
94  13 PRINT
BF  14 PRINTSPC(8)CHR$(18)"[SU,S*
    22,SI]
26  15 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
B4  16 PRINTSPC(8)CHR$(18)"[S-,SP
    C4]DATA  STATEMENT[SPC3,S-]
3C  17 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
E5  18 PRINTSPC(8)CHR$(18)"[S-]
    TO MEMORY  ROUTINE  [S-]
4A  19 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
22  20 PRINTSPC(8)CHR$(18)"[S-,SP
    C5]BY LES ALLAN[SPC5,S-]
50  21 PRINTSPC(8)CHR$(18)"[S-,SP
    C22,S-]
6C  22 PRINTSPC(8)CHR$(18)"[SJ,S*
    22,SK]
A0  23 PRINT:PRINTCHR$(155)
42  24 PRINT" THIS ROUTINE READS
    THE DATA STATEMENT,"
80  25 PRINT
17  26 PRINT" CONVERTS FROM  HEX
    TO BINARY AND POKES"
82  27 PRINT
C4  28 PRINT" CODE BACK  TO THE
    AREA OF MEMORY FROM"
84  29 PRINT
19  30 PRINT" WHICH  IT  WAS  PRE
    VIOUSLY  GENERATED."
59  31 PRINT:PRINT
D0  32 READCODE$
BB  33 LB=ASC(RIGHT$(CODE$,1))-48
    :IFLB>9THENLB=LB-7
CF  34 HB=ASC(LEFT$(CODE$,1))-48:
    IFHB>9THENHB=HB-7
32  35 PRINTSPC(5)CHR$(5)"READING
     MEMORY BLOCK ...";M1:PRINTCH
    R$(145);
28  36 POKEM1,HB*16+LB:M1=M1+1:CH
    =CH+HB+LB:IFM1<M2THEN32
D9  37 IFCH=101151THEN39
13  38 PRINT"CHECK SUM ERROR - CH
    ECK DATA STATEMENTS!":PRINTCH
    R$(19):END
EC  39 PRINT"  HIT RETURN TO SAVE
     COMPLETED PROGRAM"
D1  40 GETKEY$:IFKEY$<>CHR$(13)TH
    EN40
6B  41 SYS40000
10  42 :
CE  43 :::::::::::::::::::: DATUM S
    TATEMENTS :::::::::::::::::
16  44 :
AD  45 DATA 00,0B,08,00,00,9E,32,
    30,36,31,00,00,00,20,44,E5
28  46 DATA A9,0C,8D,20,D0,8D,21,
    D0,EA,A9,36,85,01,4C,40,23
44  47 DATA 31,34,37,29,3A,99,00,
    4F,08,0C,00,99,A6,36,29,22
22  48 DATA 12,90,D5,C3,1A,EB,C9,
    00,77,08,0D,00,99,A6,36,29
61  49 DATA 22,12,90,DD,20,1A,EB,
    DD,00,9F,08,0E,00,99,A6,36
9C  50 DATA 29,22,12,90,DD,20,1A,
    EB,DD,00,C7,08,0F,00,99,A6
8B  51 DATA 36,29,22,12,90,DD,20,
    06,EB,4C,45,54,54,45,52,20
F9  52 DATA 20,57,52,49,54,45,52,
    20,06,EB,DD,00,EF,08,10,00
13  53 DATA 99,A6,36,29,22,12,90,
    DD,20,1A,EB,DD,00,17,09,11
C3  54 DATA 00,99,A6,36,29,22,12,
    90,DD,20,1A,EB,DD,00,3F,09
AD  55 DATA 12,00,99,A6,36,29,22,
    12,90,DD,20,06,EB,42,59,20
6D  56 DATA 03,EB,4C,45,53,20,41,
    4C,4C,41,4E,20,06,EB,DD,00
46  57 DATA 67,09,13,00,99,A6,36,
    29,22,12,90,DD,20,1A,EB,DD
F7  58 DATA 00,8F,09,14,00,99,A6,
    36,29,22,12,90,DD,20,1A,EB
67  59 DATA DD,00,B7,09,15,00,99,
    A6,36,29,22,12,90,CA,C3,1A
98  60 DATA EB,CB,00,BF,09,16,00,
    99,3A,99,00,EE,09,17,00,99
20  61 DATA 22,9B,20,20,54,48,49,
    53,20,52,4F,55,54,49,4E,45
60  62 DATA 20,43,52,45,41,54,45,
    53,20,41,20,4E,4F,56,45,4C
BE  63 DATA 20,57,41,59,20,20,54,
    4F,22,00,1C,0A,18,00,99,22
9F  64 DATA 20,20,43,52,45,41,54,
    45,20,41,20,4C,45,54,54,45
E9  65 DATA 52,20,4F,4E,20,44,49,
    53,4B,20,4F,52,20,54,41,50
A3  66 DATA 45,20,20,46,4F,52,22,
    00,4A,0A,19,00,99,22,20,20
C9  67 DATA 41,20,46,52,49,45,4E,
    44,20,4F,52,20,49,4E,44,45
ED  68 DATA 45,44,20,41,4E,59,20,
    4F,54,48,45,52,20,50,55,52
51  69 DATA 50,4F,53,45,22,00,78,
    0A,1A,00,99,22,20,26,EB,22
77  70 DATA 00,A6,0A,1B,00,99,22,
    20,20,53,49,4D,50,4C,59,20
73  71 DATA 54,59,50,45,20,49,4E,
    20,59,4F,55,52,20,4C,45,54
56  72 DATA 54,45,52,20,55,53,49,
    4E,47,20,41,4C,4C,22,00,D4
CA  73 DATA 0A,1C,00,99,22,20,20,
    4B,45,59,42,4F,41,52,44,20
3C  74 DATA 43,4F,4D,4D,41,4E,44,
    53,2E,20,41,4E,59,20,4D,49
AB  75 DATA 53,54,41,4B,45,53,20,
    20,43,41,4E,22,00,02,0B,1D
C7  76 DATA 00,99,22,20,20,42,45,
    20,43,4F,52,52,45,43,54,45
27  77 DATA 44,20,55,53,49,4E,47,
    20,44,45,4C,20,4F,52,20,43
3F  78 DATA 55,52,53,4F,52,20,4B,
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   45,59,22,00,34,0B,1E,00,99
E9 79 DATA 3A,99,3A,99,22,05,20, 6E
   03,EB,50,52,45,53,53,20,52
ED 80 DATA 45,54,55,52,4E,20,54, BD
   4F,20,49,4E,49,54,49,41,4C
38 81 DATA 49,53,45,20,50,52,4F, 01
   43,45,53,53,22,00,4A,0B,1F
16 82 DATA 00,A1,4B,24,3A,8B,4B, 19
   24,B3,B1,C7,28,31,33,29,A7
6F 83 DATA 33,31,00,56,0B,20,00, 58
   9E,31,32,AC,32,35,36,00,03
AF 84 DATA EB,4B,80,00,00,A0,00, E8
   00,EE,A1,EB,A2,00,BD,00,0D
AB 85 DATA 9D,3C,03,E8,E0,A0,D0, 30
   F5,4C,3C,03,EE,F0,EB,A9,00
C8 86 DATA A8,85,FB,85,FD,A9,0E, 35
   85,FC,A9,08,85,FE,B1,FB,91
E2 87 DATA FD,C8,D0,F9,E6,FC,E6, CC
   FE,A5,FC,C9,27,D0,EF,4C,0D
AC 88 DATA 08,EE,DD,EB,00,08,08, 13
   00,00,9E,32,30,36,31,00,03
21 89 DATA EB,20,44,E5,A9,0C,8D, 97
   20,D0,8D,21,D0,EA,A9,36,85
DF 90 DATA 01,4C,AF,1F,34,37,2C, 28
   30,3A,97,34,38,2C,31,33,3A
C8 91 DATA 97,34,39,2C,30,3A,97, 49
   35,30,2C,31,33,00,49,08,0B
F6 92 DATA 00,53,B2,35,34,32,39, C2
   36,3A,58,B2,30,00,67,08,0C
B9 93 DATA 00,97,35,32,2C,31,34, 7C
   33,3A,97,35,31,2C,32,35,35
1D 94 DATA 3A,97,35,33,32,37,32, B6
   2C,32,39,00,99,08,0D,00,97
63 95 DATA 32,30,34,2C,31,3A,97, CB
   35,33,32,38,30,2C,30,3A,97
FC 96 DATA 35,33,32,38,31,2C,30, 52
   3A,97,35,33,30,36,39,2C,33
A1 97 DATA 32,3A,97,35,33,30,37, 95
   30,2C,32,30,38,00,BE,08,0E
19 98 DATA 00,97,37,38,30,2C,30, BF
   3A,97,37,38,31,2C,31,34,34
6B 99 DATA 3A,9E,35,31,30,03,ED, D2
   3A,97,35,33,32,37,32,2C,32
A6 100 DATA 37,00,CF,08,0F,00,99 8E
   ,C7,28,35,29,C7,28,31,34,37
15 101 DATA 29,38,00,DA,08,10,00 CB
   ,9E,34,39,31,35,32,00,F3,08
50 102 DATA 11,00,8B,53,46,B2,32 C9
   ,A7,97,31,36,33,38,34,AA,58
BF 103 DATA 2C,30,3A,89,32,32,00 44
   ,05,09,12,00,A1,41,24,3A,8B
67 104 DATA 41,24,B2,22,22,A7,31 B5
   ,36,00,20,09,13,00,8B,41,24
A9 105 DATA B2,C7,28,31,33,33,29 83
   ,A7,53,46,B2,53,46,AA,31,3A
B9 106 DATA 89,31,36,00,53,09,14 B8
   ,00,41,B2,C6,28,41,24,29,3A
F8 107 DATA 99,41,24,3B,3A,97,31 D7
   ,36,33,38,34,AA,58,2C,41,3A
EF 108 DATA 58,B2,58,AA,31,3A,3A CF
   ,53,46,B2,30,3A,8B,58,B1,34
2D 109 DATA 30,39,36,A7,32,32,00 03
   ,5B,09,15,00,89,31,36,00,72
4F 110 DATA 09,16,00,9E,36,35,33 F6
   ,37,31,3A,9E,36,34,37,38,39
BA 111 DATA 3A,97,53,2C,30,00,A8 9E
   ,09,17,00,97,35,33,32,37,32
EA 112 DATA 2C,32,31,3A,99,C7,28 E2
   ,35,29,C7,28,31,34,37,29,C7
35 113 DATA 28,31,37,29,C7,28,31 BF
   ,35,37,29,58,22,42,59,54,45
1B 114 DATA 53,20,4F,46,20,54,45 7F
   ,58,54,2E,22,00,C0,09,18,00
9F 115 DATA 99,3A,99,3A,85,22,46 12
   ,49,4C,45,4E,41,4D,45,20,22
F9 116 DATA 3B,46,24,00,D0,09,19 A2
   ,00,8B,C3,28,46,24,29,B2,30
DC 117 DATA A7,32,38,00,F7,09,1A FA
   ,00,81,5A,B2,31,A4,C3,28,46
B7 118 DATA 24,29,3A,97,34,39,35 D9
   ,33,35,AA,5A,2C,C6,28,CA,28
D2 119 DATA 46,24,2C,5A,2C,31,29 C6
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```
,29,3A,82,00,08,0A,1B,00,97
120 DATA 34,39,34,39,31,2C,C3 10
,28,46,24,29,00,13,0A,1C,00
121 DATA 9E,34,39,34,30,38,00 E3
,FF,ED,00,FF,ED,00,F0,ED,42
122 DATA 00,90,50,20,00,00,53 1A
,00,90,54,18,00,00,58,00,06
123 DATA ED,41,80,00,FF,8F,00 76
,FF,ED,00,FF,ED,00,FF,ED,00
124 DATA FF,ED,00,FF,ED,00,FF C8
,ED,00,FF,ED,00,FF,ED,00,FF
125 DATA ED,00,FF,ED,00,FF,ED D3
,00,FF,ED,00,FF,ED,00,FF,ED
126 DATA 00,FF,ED,00,FF,ED,00 E1
,FF,ED,00,FF,ED,00,FF,ED,00
127 DATA FF,ED,00,FF,ED,00,FF C2
,ED,00,FF,ED,00,FF,ED,00,FF
128 DATA ED,00,FF,ED,00,FF,ED B8
,00,3C,42,99,A1,A1,99,42,3C
129 DATA 06,0E,02,1E,3E,66,C6 8B
,00,FC,FE,02,FC,86,FE,FC,00
130 DATA 7C,FE,00,C0,C0,FE,7C B6
,00,FC,FE,02,C6,C6,FE,FC,00
131 DATA FE,FE,00,F0,C0,FE,FE F8
,00,FE,FE,00,F8,C0,03,ED,00
132 DATA 7C,FE,00,DE,C6,FE,7C D8
,00,C6,C6,02,FE,C6,03,ED,00
133 DATA 3C,3C,00,18,18,3C,3C 7F
,00,FE,FE,00,18,D8,F8,70,00
134 DATA CC,D8,00,F0,D8,CC,C6 9E
,00,C0,C0,00,C0,C0,FE,FE,00
135 DATA C6,EE,02,D6,C6,03,ED DC
,00,C6,C6,02,D6,CE,C6,C6,00
136 DATA 7C,FE,02,C6,C6,FE,7C 67
,00,FC,FE,02,FC,C0,03,ED,00
137 DATA 7C,FE,02,C6,C6,CE,7E DF
,01,FC,FE,02,FC,D8,CC,C6,00
138 DATA 7C,FE,00,FC,06,FE,7C B6
,00,7E,7E,00,18,04,ED,00,C6
139 DATA C6,02,C6,C6,FE,7C,00 F3
,C6,C6,02,C6,C6,6C,38,00,C6
140 DATA C6,02,C6,D6,EE,C6,00 97
,C6,6C,00,30,38,6C,C6,00,CC
141 DATA CC,00,78,30,03,ED,00 58
,FE,FE,00,38,70,FE,FE,00,3C
142 DATA 30,05,ED,3C,00,0C,12 F4
,30,7C,30,62,FC,00,3C,0C,05
143 DATA ED,3C,00,00,18,3C,7E D4
,18,04,ED,00,10,30,7F,7F,30
144 DATA 10,00,09,ED,18,04,ED 84
,00,00,18,00,66,03,ED,00,05
145 DATA ED,66,66,FF,66,FF,66 63
,66,00,18,3E,60,3C,06,7C,18
146 DATA 00,62,66,0C,18,30,66 9E
,46,00,3C,66,3C,38,67,66,3F
147 DATA 00,06,0C,18,00,05,ED 17
,0C,18,30,03,ED,18,0C,00,30
148 DATA 18,0C,03,ED,18,30,00 B4
,00,66,3C,FF,3C,66,00,03,ED
149 DATA 18,18,7E,18,18,00,07 49
,ED,18,18,30,00,03,ED,7E,00
150 DATA 09,ED,18,18,00,00,03 F3
,06,0C,18,30,60,00,7C,FE,0E
151 DATA D6,E6,C6,FE,7C,08,08 E3
,00,08,08,18,03,ED,FC,FE,02
152 DATA 06,1C,70,FE,FE,FC,FE B6
,02,3C,3C,02,FE,FC,18,18,D8
153 DATA D8,FE,18,03,ED,FE,FE CF
,00,80,FC,06,FE,FC,7C,FE,00
154 DATA C0,FC,C6,FE,7C,FE,FE 1F
,06,0C,18,10,30,30,7C,FE,06
155 DATA C6,7C,C6,FE,7C,7C,FE F3
,06,C6,7E,06,FE,7C,00,00,18
156 DATA 00,00,18,00,04,ED,18 8E
,00,00,18,18,30,0E,18,30,60
157 DATA 30,18,0E,00,03,ED,7E 0C
,00,7E,00,03,ED,70,18,0C,06
158 DATA 0C,18,70,00,3C,66,06 62
,0C,18,00,18,00,04,ED,FF,FF
159 DATA 00,03,ED,08,1C,3E,7F 3D
,7F,1C,3E,00,18,08,ED,00,03
160 DATA ED,FF,FF,00,05,ED,FF B3
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,FF,00,05,ED,FF,FF,00,09,ED
161 DATA FF,FF,00,00,30,08,ED
,0C,08,ED,00,03,ED,E0,F0,38
162 DATA 18,04,ED,1C,0F,07,00
,03,ED,18,18,38,F0,E0,00,03
163 DATA ED,C0,06,ED,FF,FF,C0
,E0,70,38,1C,0E,07,03,03,07
164 DATA 0E,1C,38,70,E0,C0,FF
,FF,C0,06,ED,FF,FF,03,06,ED
165 DATA 00,3C,7E,04,ED,3C,00
,06,ED,FF,FF,00,36,7F,03,ED
166 DATA 3E,1C,08,00,60,08,ED
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167 DATA E7,7E,3C,3C,7E,E7,C3
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168 DATA 18,66,66,18,18,3C,00
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172 DATA ED,00,0E,ED,FF,C0,08
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173 DATA 03,08,ED,00,04,ED,CC
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176 DATA 00,06,ED,FF,FF,00,03
,ED,1F,1F,18,06,ED,FF,FF,00
177 DATA 06,ED,FF,FF,18,06,ED
,F8,F8,18,03,ED,C0,08,ED,E0
178 DATA 08,ED,07,08,ED,FF,FF
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181 DATA 04,ED,F0,04,ED,0F,04
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,FF,03,01,FD,03,79,01,03,FF
183 DATA 83,01,FF,3F,3F,01,83
,FF,03,01,FD,39,39,01,03,FF
184 DATA 01,01,FF,0F,3F,01,01
,FF,01,01,FF,07,3F,03,ED,FF
185 DATA 83,01,FF,21,39,01,83
,FF,39,39,FD,01,39,03,ED,FF
186 DATA C3,C3,FF,E7,E7,C3,C3
,FF,01,01,FF,E7,27,07,8F,FF
187 DATA 33,27,FF,0F,27,33,39
,FF,3F,3F,FF,3F,3F,01,01,FF
188 DATA 39,11,FD,29,39,03,ED
,FF,39,39,FD,29,31,39,39,FF
189 DATA 83,01,FD,39,39,01,83
,FF,03,01,FD,03,3F,03,ED,FF
190 DATA 83,01,FD,39,39,31,81
,FE,03,01,FD,03,27,33,39,FF
191 DATA 83,01,FF,03,F9,01,83
,FF,81,81,FF,E7,04,ED,FF,39
192 DATA 39,FD,39,39,01,83,FF
,39,39,FD,39,39,93,C7,FF,39
193 DATA 39,FD,39,29,11,39,FF
,39,93,FF,CF,C7,93,39,FF,33
194 DATA 33,FF,87,CF,03,ED,FF
,01,01,FF,C7,8F,01,01,FF,C3
195 DATA CF,05,ED,C3,FF,09,ED
,C3,F3,05,ED,C3,FF,19,ED,E7
196 DATA 04,ED,FF,FF,E7,FF,99
,03,ED,FF,15,ED,9D,99,F3,E7
197 DATA CF,99,89,FF,C3,99,C3
,C7,98,99,C0,FF,F9,F3,E7,FF
198 DATA 05,ED,F3,E7,CF,03,ED
,E7,F3,FF,CF,E7,F3,03,ED,E7
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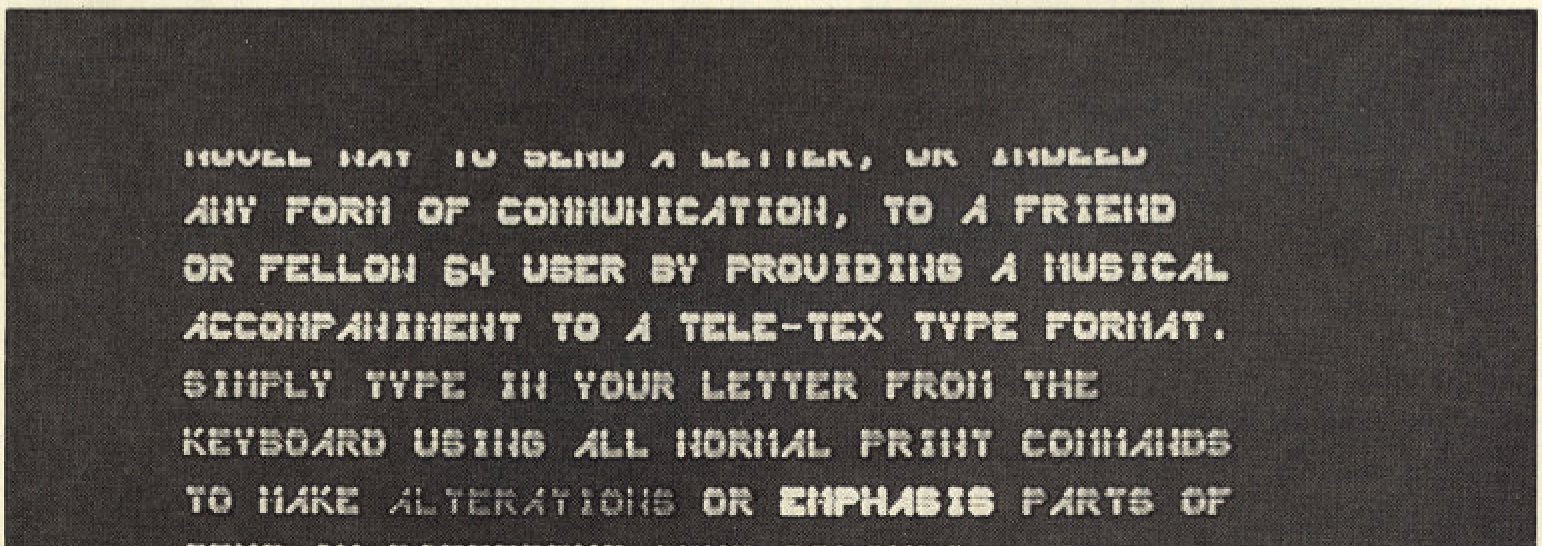
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AB 209 DATA E3,C1,80,80,E3,C1,FF
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E9 210 DATA 05,ED,00,00,FF,05,ED
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   ,C7,0F,1F,FF,03,ED,3F,06,ED
EC 213 DATA 00,00,3F,1F,8F,C7,E3
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6E 214 DATA 1F,3F,00,00,3F,06,ED
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3F 215 DATA ED,C3,FF,06,ED,00,00
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F6 217 DATA 81,18,3C,FF,C3,81,99
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99 234 DATA ED,00,FF,ED,00,FF,ED
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C5 239 DATA FF,ED,00,FF,ED,00,FF
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3F 240 DATA ED,00,FF,ED,00,FF,ED
   ,00,FF,ED,00,FF,ED,00,FF,ED
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02 242 DATA FF,ED,00,FF,ED,00,FF
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D6 243 DATA ED,00,FF,ED,00,FF,ED
   ,00,FF,ED,00,FF,ED,00,FF,ED
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E7 245 DATA FF,ED,00,FF,ED,00,FF
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CD 246 DATA ED,00,FF,ED,00,FF,ED
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A5 247 DATA 00,FF,ED,00,FF,ED,00
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A9 252 DATA 18,B2,18,B2,10,B2,10
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D0 258 DATA 08,03,51,0E,00,14,F8
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4C 259 DATA 18,A6,18,A8,08,A6,08
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4D 270 DATA 08,C2,10,C5,08,C3,08
   ,C5,08,C7,08,C8,08,C7,08,C5
EF 271 DATA 08,C7,48,C8,10,C8,08
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F4 272 DATA 20,CA,08,CE,08,CF,08
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6A 293 DATA 08,B5,08,B4,08,B5,08
   ,B7,08,BC,10,B9,08,B7,08,B4
84 294 DATA 08,B6,08,B7,08,B9,08
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06 317 DATA FF,ED,00,FF,ED,00,FF
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    ,32,30,36,31,00,03,ED,A2,00
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    ,ED.60,78,20,34,C8,58,60,A9
9E  352 DATA 01,8D,19,D0,AD,FF,CF 24
    ,F0,F5,20,85,CC,A2,7C,B5,2E
52  353 DATA 9D,BC,CC,E8,10,F8,20 32
    ,CB,C8,A2,7C,BD,BC,CC,95,2E
A8  354 DATA E8,10,F8,20,8F,CC,AD D3
    ,33,CD,CD,A2,CC,D0,13,A9,00
C8  355 DATA 8D,FE,CF,8D,2A,CD,8D 94
    ,29,CD,AD,2B,CD,29,0F,8D,2B
4A  356 DATA CD,A2,00,20,BB,C8,A2 4C
    ,07,20,BB,C8,A2,72,BD,9A,CC
9E  357 DATA 9D,8E,D3,E8,10,F7,AD 11
    ,FE,CF,D0,12,A2,0E,20,BB,C8
86  358 DATA A2,79,BD,A1,CC,9D,95 CC
    ,D3,E8,10,F7,30,12,A2,15,A0
DB  359 DATA 0E,20,BD,C8,A2,79,BD A8
    ,A8,CC,9D,95,D3,E8,10,F7,A2
DF  360 DATA 7C,BD,AC,CC,9D,99,D3 0F
    ,E8,10,F7,60,8A,A8,BD,C7,CC
1B  361 DATA F0,08,A9,00,99,04,D4 94
    ,9D,C7,CC,60,EE,A3,CC,A2,00
07  362 DATA AD,FE,CF,18,69,03,8D 9C
    ,B0,CA,BC,59,CD,84,AC,86,AD
36  363 DATA B9,A8,CC,18,7D,A4,CC 24
    ,99,A8,CC,FE,E0,CC,BD,E0,CC
89  364 DATA D9,AC,CC,90,10,BD,E4 A2
    ,CC,18,69,01,29,03,9D,E4,CC
53  365 DATA A9,01,9D,E0,CC,B9,C9 BC
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    ,CC,18,69,01,99,C9,CC,BD,30
366 DATA CD,85,AA,BD,2C,CD,85 00
    ,AB,A0,00,B1,AA,38,E9,01,C9
367 DATA 14,B0,1D,0A,A8,B9,7A 83
    ,CD,8D,38,C9,B9,7B,CD,8D,39
368 DATA C9,A0,01,B1,AA,A4,AC D1
    ,20,3A,CB,20,95,CC,4C,18,C9
369 DATA A6,AC,A4,AD,BD,A8,CC 4E
    ,D0,03,4C,E3,C9,BD,C9,CC,DD
370 DATA C8,CC,90,08,BD,C4,CC 6A
    ,F0,03,20,20,CC,BD,0E,CD,18
371 DATA 79,08,CD,9D,0E,CD,90 E1
    ,03,FE,0F,CD,A4,AD,20,E3,C8
372 DATA BD,AD,CC,F0,35,C9,06 4B
    ,90,0F,B9,E4,CC,29,01,D0,22
373 DATA BD,AD,CC,38,E9,05,10 E9
    ,14,BD,C9,CC,C9,02,90,13,BD
374 DATA A8,CC,F0,05,DD,C9,CC 12
    ,90,09,BD,AD,CC,A8,B9,5C,CD
375 DATA D0,03,BD,AA,CC,9D,10 9A
    ,CD,A4,AD,BD,AE,CC,F0,34,C9
376 DATA 02,D0,06,20,70,CC,4C 68
    ,E3,C9,C9,04,D0,0D,BD,0F,CD
377 DATA 18,7D,08,CD,9D,0F,CD 32
    ,4C,E3,C9,B9,E4,CC,29,01,D0
378 DATA 0F,BD,C5,CC,9D,0D,CD D9
    ,BD,C6,CC,9D,0C,CD,4C,E3,C9
379 DATA 20,63,CC,A6,AD,A4,AC DC
    ,DE,34,CD,BD,34,CD,F0,03,4C
380 DATA 93,CA,A9,01,99,C7,CC 82
    ,A9,00,99,0E,CD,99,C9,CC,BD
381 DATA 04,CD,99,11,CD,BD,F8 80
    ,CC,99,12,CD,BD,00,CD,99,0F
382 DATA CD,A0,00,B1,AA,F0,37 0A
    ,C9,80,90,39,18,7D,F0,CC,A2
383 DATA 07,C9,8C,90,06,E9,0C 31
    ,CA,4C,21,CA,E9,7F,0A,A8,B9
384 DATA 62,CD,8D,56,CD,B9,63 36
    ,CD,8D,57,CD,E0,00,F0,0A,4E
385 DATA 56,CD,6E,57,CD,CA,4C D6
    ,38,CA,A6,AD,4C,54,CA,8D,56
386 DATA CD,8D,57,CD,AD,56,CD 0B
    ,A4,AC,99,0D,CD,99,A8,CC,AD
387 DATA 57,CD,99,0C,CD,99,A9 76
    ,CC,A0,01,B1,AA,A4,AC,9D,34
388 DATA CD,20,95,CC,BD,34,CD EE
    ,C9,63,D0,0F,B9,A9,CC,99,C6
389 DATA CC,B9,A8,CC,99,C5,CC D4
    ,4C,11,CA,BD,FC,CC,99,10,CD
390 DATA 99,AA,CC,BD,34,CD,C9 F5
    ,01,B0,08,B9,10,CD,29,FE,99
391 DATA 10,CD,A6,AD,A5,AA,9D 4B
    ,30,CD,A5,AB,9D,2C,CD,E8,E0
392 DATA 03,B0,03,4C,D9,C8,A0 32
    ,00,B1,FA,18,65,FA,08,CD,30
393 DATA CD,90,02,28,60,C8,28 08
    ,B1,FA,65,FB,CD,2C,CD,D0,0F
394 DATA A9,00,8D,FF,CF,A2,60 F1
    ,A9,00,9D,AC,CC,E8,10,FA,60
395 DATA A2,7C,A9,01,8D,97,CA FE
    ,9D,B8,CC,E8,10,FA,A5,FA,18
396 DATA 69,04,8D,30,CD,A5,FB D2
    ,69,00,8D,2C,CD,A2,7E,A0,00
397 DATA B1,FA,18,6D,30,CD,9D AC
    ,B3,CC,08,C8,28,B1,FA,6D,2C
398 DATA CD,9D,AF,CC,C8,E8,10 FF
    ,E8,A9,01,8D,FF,CF,A9,00,8D
399 DATA FE,CF,AA,9D,A1,CC,E8 29
    ,10,FA,60,8D,2B,CD,60,9D,FC
400 DATA CC,60,9D,04,CD,60,9D 68
    ,F8,CC,60,8D,54,CD,BD,E8,CC
401 DATA D0,0B,A9,01,9D,E8,CC 3C
    ,AD,54,CD,9D,3C,CD,DE,3C,CD
402 DATA BD,3C,CD,F0,0B,BD,44 4F
    ,CD,85,AA,BD,48,CD,85,AB,60
403 DATA A9,00,9D,E8,CC,60,A5 A2
    ,AA,9D,44,CD,A5,AB,9D,48,CD
404 DATA 60,8D,54,CD,BD,EC,CC 26
    ,D0,0B,A9,01,9D,EC,CC,AD,54
405 DATA CD,9D,40,CD,DE,40,CD D0
    ,BD,40,CD,F0,0B,BD,4C,CD,85
406 DATA AA,BD,50,CD,85.AB.60 AE
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    ,A9,00,9D,EC,CC,60,A5,AA,9D
407 DATA 4C,CD,A5,AB,9D,50,CD
    ,60,9D,F0,CC,60,9D,08,CD,60
408 DATA 9D,A4,CC,60,9D,F4,CC
    ,60,9D,00,CD,60,C9,64,90,07
409 DATA 38,E9,64,8D,97,CA,60
    ,99,AB,CC,60,99,AC,CC,60,99
410 DATA AD,CC,60,99,AE,CC,60
    ,99,C4,CC,60,99,CA,CC,60,99
411 DATA C8,CC,60,BD,C9,CC,DD
    ,C8,CC,90,F7,AD,A3,CC,29,07
412 DATA 4A,F0,1A,C9,01,F0,4E
    ,C9,03,F0,4A,BD,A9,CC,18,7D
413 DATA CA,CC,9D,0C,CD,BD,A8
    ,CC,69,00,4C,1C,CC,BD,A9,CC
414 DATA 38,FD,CA,CC,9D,0C,CD
    ,BD,A8,CC,E9,00,9D,0D,CD,60
415 DATA C9,01,D0,36,BD,C5,CC
    ,DD,A8,CC,90,1C,D0,08,BD,C6
416 DATA CC,DD,A9,CC,90,12,BD
    ,A9,CC,18,79,F4,CC,9D,A9,CC
417 DATA 90,03,FE,A8,CC,4C,63
    ,CC,BD,A9,CC,38,F9,F4,CC,9D
418 DATA A9,CC,B0,03,DE,A8,CC
    ,4C,63,CC,C9,03,F0,EA,C9,04
419 DATA F0,D4,60,BD,A8,CC,9D
    ,0D,CD,BD,A9,CC,9D,0C,CD,60
420 DATA B9,E4,CC,29,01,D0,EC
    ,BD,A8,CC,4A,9D,0D,CD,BD,A9
421 DATA CC,6A,4C,6C,CC,A5,01
    ,8D,58,CD,A9,00,85,01,60,AD
422 DATA 58,CD,85,01,60,A5,AA
    ,18,69,02,85,AA,90,02,E6,AB
423 DATA 60,00,00,F6,00,04,ED
    ,04,59,41,00,04,ED,27,11,41
424 DATA 00,04,ED,41,B4,81,00
    ,10,ED,06,14,00,34,26,00,0F
425 DATA 06,FF,00,05,ED,07,00
    ,08,ED,01,03,ED,00,02,03,ED
426 DATA 00,03,ED,01,00,05,ED
    ,01,01,00,03,ED,64,00,00,2A
427 DATA 2A,0E,00,41,41,81,00
    ,01,01,00,00,19,1F,03,00,96
428 DATA 1E,00,00,59,04,84,04
    ,41,19,2A,11,27,B4,01,41,1F
429 DATA 2A,B4,41,00,00,81,03
    ,0E,00,0A,ED,0F,90,91,92,00
430 DATA 72,4A,14,00,09,18,03
    ,01,00,06,ED,0F,00,03,ED,11
431 DATA 00,6A,08,10,00,90,91
    ,92,00,2E,06,84,00,90,91,91
432 DATA 00,28,00,27,11,37,00
    ,07,0E,15,41,21,11,81,51,83
433 DATA 68,8B,39,93,80,9C,45
    ,A5,90,AF,69,B9,D7,C4,E3,D0
434 DATA 99,DD,00,EA,25,F8,10
    ,2A,CB,32,CB,2E,CB,B8,CB,BC
435 DATA CB,03,ED,CF,CB,D3,CB
    ,DF,CB,36,CB,DB,CB,B0,CB,B4
436 DATA CB,AC,CB,D7,CB,3A,CB
    ,66,CB,71,CB,9D,CB,A8,CB,03
437 DATA B8,03,00,07,0E,15,0A
    ,0B,28,64,14,0B,00,00,41,21
438 DATA 11,81,00,B2,B7,B7,00
    ,02,00,03,ED,14,1E,24,00,64
439 DATA 03,ED,00,14,0C,34,00
    ,64,66,68,00,83,68,8B,39,93
440 DATA 80,9C,45,A5,90,AF,69
    ,B9,D7,C4,E3,D0,99,DD,00,EA
441 DATA 25,F8,10,00,03,ED,77
    ,00,16,ED,20,5B,FF,20,15,FD
442 DATA 5A,20,60,CF,7A,A9,00
    ,3A,85,FD,A9,40,85,FE,FA,DA
443 DATA A9,1B,5A,8D,11,D0,8D
    ,18,D0,20,60,CF,20,60,CF,20
444 DATA 60,CF,A9,C8,8D,16,D0
    ,78,5A,A9,0B,8D,20,D0,A9,00
445 DATA 8D,21,D0,A2,90,EA,EA
    ,FA,20,38,C7,DA,20,60,CF,7A
446 DATA 7A,A9,01,8D,86,02,A9
    ,7E,8D,7B,C7,A9,F6,8D,29,03
447 DATA 7A,58,20,60,CF,20,60
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    ,CF,07,60,3A,03,ED,A9,FF,85
F3  448 DATA 00,20,2E,CF,A0,00,B1
    ,FD,C9,FF,D0,08,A9,20,8D,89
DE  449 DATA CF,4C,20,CF,C9,FE,D0
    ,08,A9,16,8D,89,CF,4C,20,CF
91  450 DATA C9,FD,DA,DC,08,A9,0C
    ,8D,89,CF,4E,20,CF,C9,FC,D0
E6  451 DATA 09,A9,02,8D,89,CF,4C
    ,20,CF,7A,C9,FB,D0,05,A9,01
AA  452 DATA 4C,61,CF,C9,FA,D0,05
    ,A9,05,4C,61,CF,C9,F9,5A,D0
D2  453 DATA 05,A9,19,4C,61,CF,C9
    ,00,D0,5D,3A,EE,8C,CF,A9,F8
52  454 DATA 8D,00,C0,A9,00,AA,A8
    ,E8,D0,FD,C8,D0,FA,EE,00,C0
71  455 DATA AD,00,C0,D0,F2,A9,93
    ,20,D2,FF,4C,03,CE,D0,F0,EE
CC  456 DATA D7,CE,AD,D7,CE,C9,30
    ,D0,E6,88,5A,D0,D8,78,3A,A9
86  457 DATA FF,8D,0E,D4,A9,81,8D
    ,12,D4,4C,00,CE,85,03,A0,00
1F  458 DATA 84,02,AD,1B,D4,91,02
    ,C8,D0,F8,E6,03,A5,03,C9,CF
45  459 DATA D0,F0,6C,1B,CF,E2,FC
    ,20,D2,FF,20,26,CF,4C,67,CE
FC  460 DATA 7A,E6,FD,D0,02,E6,FE
    ,60,38,20,0A,E5,DA,B1,D1,48
82  461 DATA A5,D1,85,02,A5,D2,18
    ,69,D4,85,03,AD,86,02,91,02
03  462 DATA A9,A0,91,D1,A9,00,8D
    ,20,D0,AE,89,CF,CA,F0,08,AD
BD  463 DATA 12,D0,D0,FB,4C,52,CF
    ,68,91,D1,60,8D,8B,CF,FA,AD
FE  464 DATA 89,CF,8D,8A,CF,3A,A9
    ,20,8D,89,CF,20,2E,GF,CE,8B
12  465 DATA CF,D0,F8,AD,8A,CF,8D
    ,89,CF,AD,8C,CF,D0,03,4C,20
3B  466 DATA CF,7A,60,20,20,00,1C
    ,45,00,CA,C0,00,07,ED,AC,00
31  467 DATA 66,ED,01,A2,00,BD,F1
    ,1F,9D,10,01,E8,D0,F7,A2,34
C2  468 DATA BD,58,20,9D,00,03,E8
    ,D0,F7,EA,EA,A2,FF,9A,A9,00
01  469 DATA 85,2D,38,E9,01,85,FE
    ,A9,D0,85,2E,E9,00,85,FF,A9
6C  470 DATA AE,85,FC,A9,1F,85,FD
    ,AD,21,D0,85,FB,4C,52,01,00
C3  471 DATA 07,EB,39,08,0A,00,97
    ,34,33,2C,30,31,3A,97,34,34
1E  472 DATA 2C,38,3A,97,34,35,2C
    ,30,3A,97,34,36,2C,31,33,3A
10  473 DATA 97,48,C6,FC,A5,FC,C9
    ,FF,D0,02,C6,FD,68,60,48,AD
14  474 DATA 20,D0,49,03,8D,20,D0
    ,C6,FE,A5,FE,C9,FF,D0,02,C6
AD  475 DATA FF,68,60,A0,00,B1,FC
    ,C9,ED,D0,18,EA,03,EB,20,30
90  476 DATA 01,B1,FC,AA,20,30,01
    ,B1,FC,91,FE,20,3D,01,CA,D0
D9  477 DATA F8,F0,05,91,FE,20,3D
    ,01,A6,FC,CA,86,FC,E0,FF,D0
CE  478 DATA 02,C6,FD,A5,FE,C9,1F
    ,A5,FF,E9,08,B0,C8,A5,FB,8D
CD  479 DATA 20,D0,A9,37,85,01,20
    ,60,A6,20,8E,A6,A2,1F,BD,10
CC  480 DATA 01,9D,00,08,CA,D0,F7
    ,A9,ED,4C,34,03,4C,AE,A7,EE
A3  481 DATA A2,00,BD,82,23,9D,10
    ,01,E8,D0,F7,A2,34,BD,E9,23
84  482 DATA 9D,00,03,E8,D0,F7,EA
    ,EA,A2,FF,9A,A9,90,85,2D,38
4C  483 DATA E9,01,85,FE,A9,26,85
    ,2E,E9,00,85,FF,A9,3F,85,FC
8E  484 DATA A9,23,85,FD,AD,21,D0
    ,85,FB,4C,52,01,00,00,00,00
C0  485 DATA 00,00,00,19,08,0A,00
    ,97,35,33,32,38,30,2C,31,35
2F  486 DATA 3A,97,35,33,32,38,31
    ,2C,31,32,00,27,08,08,00,99
AD  487 DATA C7,28,48,C6,FC,A5,FC
    ,C9,FF,D0,02,C6,FD,68,60,48
FE  488 DATA AD,20,D0,49,03,8D,20
    ,D0,C6,FE,A5,FE,C9,FF,D0,02
C7  489 DATA C6,FF,68,60,A0,00,B1
    ,FC,C9,EB,D0,18,EA,EA,EA,20
8B  490 DATA 30,01,B1,FC,AA,20,30
    ,01,B1,FC,91,FE,20,3D,01,CA
0F  491 DATA D0,FB,F0,05,91,FE,20
    ,3D,01,A6,FC,CA,86,FC,E0,FF
4A  492 DATA D0,02,C6,FD,A5,FE,C9
    ,1F,A5,FF,E9,08,B0,C8,A5,FB
02  493 DATA 8D,20,D0,A9,37,85,01
    ,20,60,A6,20,8E,A6,A2,1F,BD
AD  494 DATA 10,01,9D,00,08,CA,D0
    ,F7,A9,EB,4C,34,03,4C,AE,A7
17  495 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
16  496 DATA EE,EE,EE,EE,EE,EE,EE
    ,EE,EE,EE,EE,EE,EE,EE,EE,EE
7B  497 DATA A9,00,A8,85,FB,85,FD
    ,A9,80,85,FC,A9,08,85,FE,B1
B5  498 DATA FB,91,FD,C8,D0,F9,E6
    ,FC,E6,FE,A5,FC,C9,A0,D0,EF
DF  499 DATA A5,BA,AA,A8,20,BA,FF
    ,A9,0D,A2,8C,A0,9C,20,BD,FF
0A  500 DATA A9,01,85,2B,A9,08,85
    ,2C,A9,2B,A2,20,A0,24,20,D8
3D  501 DATA FF,4C,66,FE,EE,EE,EE
    ,EE,EE,EE,EE,EE,4C,45,54,54
0D  502 DATA 45,52,20,57,52,49,54
    ,45,52,EE,EE,EE,EE,EE,EE,EE
C2  503 :
C3  504 :
FA  505 :::::::::::::::::::::::::
    ::::::::::::
FB  506 :
                :
D1  507 :   LETTER WRITER   BY LE
    S ALLAN     .
01  508 :
                :
FF  509 :   28 ATKINSON DRIVE NEW
    PORT IW     :
FF  510 :
                :
48  511 :::::::::::::::::::::::::
    ::::::::::::
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Red Boxes

Now there's a home control system available for the C64, which will switch on the kettle and the telly or even warn of intruders.

By Mycroftt Appleby

Home control has always been promoted as one of the major uses of computers in the coming years. However, in the past home control systems were expensive, difficult to use, and were only available on micros with good, complex interfacing systems like the BBC Micro. More common computers like the Commodore 64 were not really used at all. One unbuffered user port that doubled as an RS232, and an obscure custom serial system, isn't really the stuff that interfacing dreams are made of.

Finally, there is now on the market an easy to use home control system that is available across a range of micros including the Commodore 64. The starter pack for *Red Boxes* comprises the main controller — called 'Red Leader', and two control units — an infra-red detector (red two) and a plug actuator (red one). The concept behind the *Red Boxes* is the controller unit 'talking' to all the other units via a modulated serial link via the mains.

Red Leader is a computer in itself. Comprising a 6502 derivative processor just like the C64, 8K of RAM, and a BBC-like control Basic. The Commodore 64 connects to this and is used as a terminal. The way this is done is extremely clever. A wire is connected on the C64. Press 'Run/Stop' and the Red Leader behaves just like a cassette player, sending cassette-type signals to the Commodore 64.

After a short time the terminal program is loaded into the computer and the link between the Red Leader and the Commodore 64 turns into a proper two-way serial link. You will then drop into the control program mode.

This mode is the simplest operating method on the *Red Boxes* system (the other being Red Basic, but more of that later). You are presented with a menu where you can log-on devices (i.e. tell Red Leader that they exist) type in their code addresses, turn them on or off and set them up to turn on or off at specific times. You can even relate the input of one to the output of another so that a movement on the infra-red detector will activate an alarm for instance.

This program, whilst being extremely simple, is also quite powerful and lets you perform all the major actions that you would want to in a quick and easy manner. However for complex, multi-unit, interaction you need to get down to some planning and programming. For this you need to use Red Basic and probably need to get hold of the Projects Manual (good value at £9).

Documentation

The manual supplied gives you some simple information on the Basic, but is really aimed at tbe inexperienced user so goes into more detail about the menu program. The Projects Manual on the other hand, is one of the better tomes that I have read. Going into enough detail for the experienced programmer out to do something really flashy, or the beginner who is au fait with Commodore Basic and wants to get down to using Red Basic.

If you have ever used a BBC micro you will be immediately used to Red Basic as Red Basic is a subset of BBC Basic, with a lot of extra commands added to handle the control aspect of the system. If you think that Red Basic being the same as BBC Basic is a little strange, then you won't when you hear about the Founder of General Information Systems (the people who make Red Boxes). Chris Curry (for it is he) started Acorn many years ago and this is one of the first projects that he has embarked on since the Acorn shake up.

As well as most of the BBC Basic commands and instructions — which includes most of the structured programming aids (repeat, gosub name, long variable names etc.) there are commands to log-on devices and manipulate them. As this Basic is a lot more advanced than the Commodore 64 Basic, you should have no trouble at all in telling units to do whatever you want, especially with the real-time commands. These are commands that are very similar to some commands on the Amstrad. Sections of program are executed when an external device instructs them. So if the timer section of your program is controlling the

heating and a burglar trips the infra-red motion detector then the 'alarm' section of your program can be activated.

8K may not sound like a lot, but try and think of the last time that you wrote a program that was actually 8K in length. Remember, you don't have to worry about screen or colour memory, or sprites, or sound. The Commodore 64 handles all of that. And if Basic is a bit tight you can always switch to machine code.

The Red Leader uses a 6502 processor, and you can program it in machine code by pokeing code into memory and then executing it. The Projects manual carrys a list of operating system functions which are very similar in a lot of ways to the Commodore Kernal system. The Basic has the same memory management aids as the original BBC Basic with pseudo-variables like Page and Top to indicate when the Basic program is going to sit, and Lomem and Himem to reserve space for the machine code area. The operating system and memory areas are also very similar to the BBC, even down to where the system memory ends.

The Basic can also save any programs written under it to a tape connected to the Commodore 64. To do this, the Red Leader first transfers the contents of its memory to the C64. You must then disconnect Red Leader and connect up a tape recorder, and write to tape. Then re-connect everything up.

The main plugs of this system is that when you have a program debugged and working to your satisfaction, you can unplug the Commodore 64 from Red Leader completely and use it for something else or whatever. Yet, Red Leader will just sit there executing your program forever. However, you can leave your Commodore 64 connected if you want to — if you need to see information displayed on the screen for instance — though the power consumption over a period of time would be offputting. The Red Leader on its own uses up very little power, and it is feasible to leave it switched on all the time.

Reds One and Two

The two units supplied with the starter pack are Red One and Red Two (sounds a bit like something out of Apocalypse Now). Red One is the actuator. This is a unit that plugs into the mains at one end and then has a mains socket at the other. Anything you like can be connected to this and turned on and off from Red Leader. There is also a manual override on the unit to toggle it on and off as you see fit. An LED on the box tells you whether it is on or off.

Red Two is an infra-red motion detector. One end plugs into the mains (as usual) and at the other end is a small box about half the size of Red One and Red Leader. In this is a large window. If anything that is at a different temperature than the surrounding air moves within 16 feet of it then a signal is sent back to Red Leader.

All three units come with wall mounting brackets with all screws and Rawlplugs, though they don't need to be wall mounted, it is excellent that these are included. The cables are also very long, over six feet in most cases. This is just about the right length. Usually on systems such as these the cables are not quite long enough. I think that they got it right this time.

In the near future GIS will be releasing an alarm unit and an analog input unit. These will allow you to build up an alarm system more easily or control a thermostat for heating. Next in line are temperature probes and an RS232 link.

This last unit will allow your computer to talk to a printer in another room, or even another building, by sending its information down the mains line. This could also be used in networking computers in a simple and easy manner.

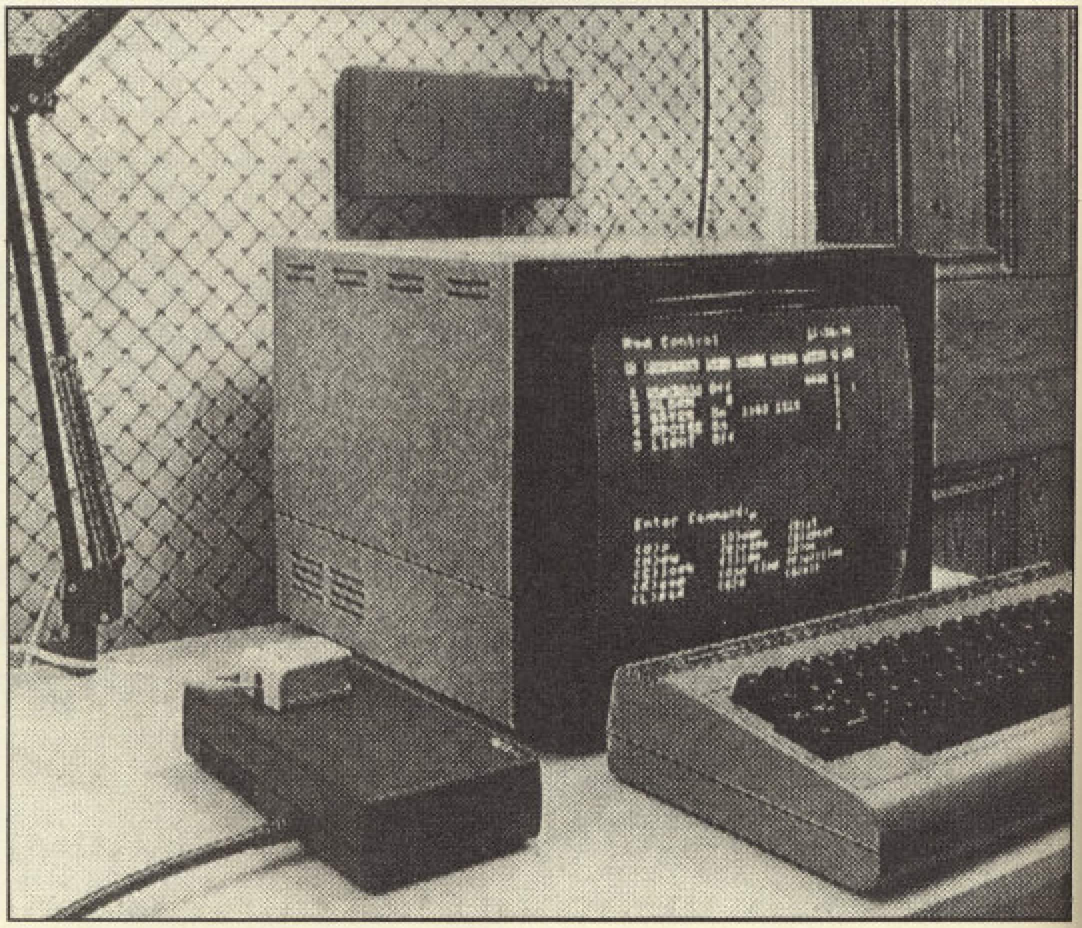
If anyone is worrying about the mains system, don't. It is perfectly safe and very well worked out. Each unit has its own unique serial number and the Red Leader has to know what it is. So whilst you could control your next door neighbour's heating system, you'd have to know his encryption code first. However, if you wanted to communicate with a friend down the road, as long as you were on the same local ring main, and within a few hundred yards, you could do it.

Verdict

On the whole this is a brilliant system. One of my main interests in computers is in the field of real event control. And this is the easiest to use, safest, and most well thought out system that I have ever seen. This only obstacles in its path are public resistance to this sort of thing, and the price which, though low for a control system, is still high for the average Commodore owner. I will watch this with interest.

Touchline

Company: *General Information Systems, 1 White Hart Yard, London SE1 1NX.* ***Price:*** *£129 (starter pack).*



Letters

Your opinions are what counts. Let us know how you feel about anything connected with Commodore computers.

Pat on the Back

May I congratulate you on the new layout and style of *Your Commodore*. It is a great improvement. I am glad to see you have stayed away from the craze in other magazines for catering for games players at the expense of the rest of us. The contents seem to me now to be just about right. The magazine is well laid out, with a good clear typeface and the type-in listings are much clearer.

There is only one fault. Did your proof reader once work for *The Guardian?* I ask this as I have spotted a number of typographical errors throughout the magazine.

Your Commodore must now go to the top of the class for getting the formula right. I buy most magazines for the Commodore including some American and Canadian ones. *Your Commodore* is now the best for lay out the content.

The free tape has gone into my collection of utilities. I already had most of the utilities but not in two such useful programs. I will be using them often.

As an ancient in my mid-forties, I find using my computer for letter writing and working on a novel (for enjoyment not for publication) very relaxing after a hard days work on the roads as a council worker. Keep up the good work.

David Peacock, Fleetwood

Thank you for your all too well deserved praise, David (well, why be modest?). Our proof reader has been soundly whipped and demoted to tea lady until such time as she sees the error of her ways!
Ed.

Labour of Love

Having recently received my copy of *Your Commodore* January '87, I was interested in an article by Stuart Cooke on Fault Finding. I am sure that a lot of readers will find it very helpful.

It wasd not long after purchasing my first computer that I came up against a problem which I found very frustrating. It was the difficulty of typing in listings without making mistakes. Although I can type about 35 words per minute when writing a letter, it is quite a different problem trying to read the listing and type at the same time. I have to see the keys and see where my fingers are going. Thus when constantly having to stop and read the listing, then remember it, the task could be quite infuriating.

After giving the matter some thought I devised a method that has worked perfectly for myself, and perhaps it may be of use to others.

I record the whole program on a tape recorder at such a speed that when played back, it allows me to sit comfortable and type merrily away without having to take my eyes off the keyboard. If a foot switch is inserted in the control line for stop and start of the recorder it is possible to stop at once correct the mistake, or if the recording has got a little ahead of your typing catch up before operating the foot switch once more.

It does take time to record the listing, but the elimination of constant mistakes in typing and most of all the frustration of continually correcting them, has been a great boon.

I hope that this suggestion will be of value to other readers.

Flight Lieutenant C.Lee RAF (ret'd) Harlepool.

If any other readers have ingenious time saving ideas, perhaps they would like to pass on their pearls of wisdom for the enlightenment of the masses.
Ed.

Disillusioned

I refer to the letter from H.Jenkins in your January issue. I am afraid that I do not share his enthusiasm for the C16/Plus/4 User Club.

Having paid up subscription in mid-November, I am still waiting for the so called 'magazine' for November, December and January. '20 User' did appear in August, September and October as very poor 8" X 6" pamphlets.

Unfortunately, this is not the first time I have lost out on clubs who start in a blaze of enthusiasm and disappear within a month or so. My experience is probably shared by hundreds of other computer owners whose eagerness is blunted by being ripped off in a similar fashion.

I can only suggest that your readers think twice before parting with their cash, particularly if the publication is not available at a newsagent like your own magazine.

David Jackson, Luton

We would like to recommend to readers that they check out the reputation of computer clubs as far as possible before parting with any money. If you have any reason at all to doubt the reliability of a club then don't send any money. ICPUG is probably the most well known Commodore club and they may be able to give you information as to specific groups or clubs which they have checked out themselves. Contact: ICPUG, 30 Brancaster Road, Newbury Park, Ilford, Essex IG2 7EP.

Double Print

If you want to attract someone's attention to something, then the bigger the better. This utility allows you to use double height characters on a C64.

By Bruce Durant

When printing text on the screen of a Commodore 64 you are normally stuck with the standard small size character set. Should you require to attract someone's attention to a piece of text then you can change the colour, reverse it etc.

This program, for the C64, makes it possible to highlight your text with double size characters (16×16) adding a new dimension to your text displays.

The program is written entirely in machine code. The version printed here is presented in the form of a Basic loader which POKEs the machine code and the new character set into memory.

Also printed here is a demonstration program which is automatically loaded by the machine code loader.

In Use

This program makes it possible to have both the new expanded character set and the normal C64 character set on screen at any one time. Switching between the two character sets is extremely easy. Insert a CONTROL-D character into a print statement and the text will appear in double size print. A CONTROL-N character will return things to normal. The demonstration program makes this a little clearer.

The machine code program has four sections.

a) A machine code routine that turns off the interrupts, wedges in the new vectors for the double height program and moves the new character set from $0800 to $1000.

b) The new interrupt routine. This looks for raster interrupts at predefined lines that correspond to the text lines. When the interrupt occurs the character set and next raster line are set.

c) The new print routine. This first establishes that output is to the screen, then it fixes the character set and outputs using the C64's KERNAL print routine.

d) The new character set. This is initially stored at $C200 to $CA00 until moved by routine (a).

The whole program can be saved as a machine code routine from $C000 to $CA00 provided that any program that uses it moves the start of Basic up to $1000. Use SYS 49152 to start the program.

PROGRAM:DBLPRINT LOADER

```
85  0 REM **********************
    *********
8E  1 REM *
          *
C2  2 REM *      DOUBLE PRINT LOA
    DER       *
8C  3 REM *
          *
56  4 REM *  COPYRIGHT B.R.DURAN
    T 1986   *
8A  5 REM *
          *
3F  6 REM **********************
    *********
92  10 POKE53280,0:POKE53281,0:P
    RINT"[CLR,CYAN]";:PRINTTAB(1
    0)"DOUBLE PRINT LOADER"
7E  20 PRINT:PRINT" RESETS START
     OF BASIC TO $1000 & THEN"
D8  30 PRINT"AUTO LOADS & RUNS B
    OTH DOUBLE PRINT &[SPC3]THE
    MAIN PROGRAM."
41  40 PRINT" THE MAIN PROGRAM S
    HOULD SET THE SCREEN"
51  50 PRINT"COLOURS & 'SYS49152
    ' IN ITS 1ST LINE."
80  60 PRINT" THIS TEXT CAN BE D
    ELETED OR MODIFIED TOTASTE."
92  70 PRINT" TO USE DOUBLE PRIN
    T EITHER INSERT A"
0F  80 PRINT"[CTRL/D] IN THE PRI
    NT STRING OR CHR$(4).";
56  90 PRINT" TO SWITCH BACK USE
     [CTRL/N] OR CHR$(14)OR CHR$
    (142)."
82  100 PRINT" WHEN LOADED THE M
    AIN M/C ROUTINE LIES @$C000
    TO $C200.";
04  110 PRINT"THE NEW CHARACTER
    SET 1STOCCUPIES $C200 TO $CA
    00,WHEN ACTIVATED";
7A  120 PRINT"  IT IS MOVED TO $
    0800 TO $1000."
B8  130 PRINT" A PROGRAM USING D
    OUBLE PRINT SHOULD BE IN 2 P
    ARTS :-"
CA  140 PRINT" 1.LOADER TO RESET
     BASIC & LOAD M/CODE "
16  150 PRINT"[SPC3]DATA THEN LO
    AD & RUN PART2":PRINT" 2.MAI
    N PROGRAM"
91  160 PRINTTAB(8)"[C@25]"
27  170 PRINTTAB(8)"[RVSON]PRESS
     ANY KEY TO CONTINUE"
E2  180 GETA$:IFA$=""THEN180
BA  190 REM LOAD M/CODF
78  200 GOSUB300
5F  210 PRINTTAB(8)"[RVSON]PRESS
     ANY KEY TO CONTINUE"
21  220 GETA$:IFA$=""THEN220
43  230 PRINT"[CLR,BLACK]":REM C
    LEAR & BLACK SCREEN
C1  240 REM SETUP BASIC & KEYBOA
    RD BUFFER
21  250 POKE44,16:POKE4096,0:POK
    E631,131:POKE632,13:POKE198,
    2
CB  252 REM IF USING DISK CHANGE
     ABOVE LINE TO
D9  253 REM POKE44,16:POKE4096,0
    :LOAD "DBL PRINT SAMPLE",8
48  254 REM THEN RUN THIS PROGRA
    M WHEN LOADED
61  260 NEW:END
BF  300 REM M/CODE DATA LOADER &
     ERROR TRAP
37  310 PRINT"[CLR,CYAN]";:PRINT
    TAB(10)"DOUBLE PRINT LOADER"
    :PRINT
8B  320 PRINT"[SPC8]DATA LOADER
    & ERROR TRAP":PRINT
27  330 PRINT"[SPC5]PLEASE WAIT
    FOR M/CODE TO LOAD":PRINT
2A  340 PRINT"[SPC6]LEAVE PLAY O
    N TAPE DEPRESSED":PRINT
C6  350 READSA:READEA:READLN:REA
    DIN
DA  360 FORN=SATOEASTEP16:T=0:FO
    RI=0TO15
27  370 IFN+I>EATHENI=15:GOTO390
FC  380 READP:POKEN+I,P:T=T+P
C3  390 NEXTI:READP:IFT<>PTHENPR
    INT"ERROR IN LINE"LN:END
1B  400 LN=LN+IN:NEXTN:PRINT"FIN
```

```
    ISHED LOADING":RETURN
1E  500 REM DBLPRINT M/CODE
DE  501 DATA 49152, 51712, 502,
    1
CC  502 DATA 120,169,127,141,13,
    220,169,1,141,26,208,141,18,
    208,169,255, 2126
B8  503 DATA 133,251,173,17,208,
    41,127,141,17,208,169,125,14
    1,20,3,169, 1943
62  504 DATA 192,141,21,3,169,19
    7,141,38,3,169,192,141,39,3,
    169,0, 1618
02  505 DATA 133,90,169,202,133,
    91,169,0,133,95,169,194,133,
    96,169,0, 1976
FB  506 DATA 133,88,169,16,133,8
    9,32,191,163,88,96,19,19,21,
    21,21, 1299
C5  507 DATA 19,19,19,19,19,19,1
    9,19,19,19,19,19,21,23,23,23
    , 318
38  508 DATA 23,21,21,21,58,66,7
    4,82,90,98,106,114,122,130,1
    38,146, 1310
C5  509 DATA 154,162,170,178,186
    ,194,202,210,218,226,234,242
    ,1,173,25,208, 2783
CA  510 DATA 141,25,208,41,1,240
    ,20,230,251,166,251,189,75,1
    92,141,24, 2195
EA  511 DATA 208,189,100,192,141
    ,18,208,224,24,240,3,76,188,
    254,169,255, 2489
42  512 DATA 133,251,76,49,234,6
    4,0,0,0,0,0,0,0,0,0, 807
D5  513 DATA 0,0,0,0,0,91,92,93,
    94,95,219,220,221,222,223,0,
     1570
4F  514 DATA 0,0,0,0,192,72,165,
    154,201,3,240,3,76,213,241,1
    04, 1664
D6  515 DATA 133,215,72,138,72,1
    52,72,166,215,164,214,138,41
    ,127,201,32, 2152
08  516 DATA 176,58,173,136,2,10
    ,10,41,240,224,147,208,23,16
    0,0,132, 1740
D2  517 DATA 211,132,214,9,5,153
    ,75,192,200,192,25,144,248,1
    38,32,172, 2142
52  518 DATA 193,76,168,230,224,
    14,240,235,224,142,208,4,9,7
    ,208,229, 2411
A9  519 DATA 224,4,208,4,9,3,208
    ,221,224,13,208,225,185,75,1
    92,41, 2044
BB  520 DATA 4,208,218,224,13,20
    8,6,138,32,172,193,208,208,1
    65,215,201, 2413
95  521 DATA 64,144,21,201,91,14
    4,25,201,191,176,2,105,96,19
    7,192,144, 1994
2E  522 DATA 4,201,219,144,11,76
    ,168,230,41,31,168,185,165,1
    92,240,245, 2320
6A  523 DATA 72,169,0,133,199,16
    4,211,192,39,144,8,169,13,32
    ,172,193, 1910
2E  524 DATA 32,172,193,166,214,
    224,24,144,10,169,17,32,172,
    193,169,145, 2076
9E  525 DATA 32,22,231,104,32,15
    8,193,56,233,32,133,215,166,
    214,164,211, 2196
FB  526 DATA 192,40,48,8,160,38,
    32,153,193,76,168,230,136,13
    6,232,32, 1874
FE  527 DATA 153,193,169,145,133
    ,215,76,29,231,32,12,229,165
    ,215,32,172, 2201
82  528 DATA 193,165,199,73,1,13
    3,199,165,215,76,172,193,72,
    41,127,201, 2225
9E  529 DATA 19,240,60,165,214,2
    01,24,144,54,165,218,9,128,1
    33,218,165, 2157
38  530 DATA 217,41,127,133,217,
    165,241,9,128,133,241,104,32
    ,22,231,72, 2113
4F  531 DATA 165,217,16,19,138,7
    2,162,1,189,75,192,202,157,7
    5,192,232, 2104
72  532 DATA 232,224,25,208,243,
    104,170,165,217,9,128,133,21
    7,104,96,104, 2379
71  533 DATA 32,22,231,96,0,0,0,
    234,1,234,1,234,227,238,234,
    72, 1856
22  534 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,7,12,24, 43
9F  535 DATA 24,24,24,24,24,27,2
    8,24,0,0,0,0,0,3,6,12, 220
0F  536 DATA 0,0,0,0,0,7,12,24,0
    ,0,0,0,0,7,12,24, 86
BF  537 DATA 1,3,3,3,3,15,3,3,0,
    0,0,0,0,7,12,24, 77
78  538 DATA 12,12,12,12,12,13,1
    4,12,0,0,1,1,0,1,1,1, 104
0A  539 DATA 0,0,0,0,0,0,0,0,6,6
    ,6,6,6,6,7,6, 49
26  540 DATA 12,12,12,12,12,12,1
    2,12,0,0,0,0,0,110,49,49, 30
    4
F8  541 DATA 0,0,0,0,0,13,14,12,
    0,0,0,0,0,3,6,12, 60
AB  542 DATA 0,0,0,0,0,13,14,12,
    0,0,0,0,0,7,12,24, 82
7E  543 DATA 0,0,0,0,0,13,14,12,
    0,0,0,0,0,7,12,12, 70
04  544 DATA 0,6,6,31,6,6,6,6,0,
    0,0,0,0,12,12,12, 103
5E  545 DATA 0,0,0,0,0,24,24,12,
    0,0,0,0,0,96,97,99, 352
9D  546 DATA 0,0,0,0,0,12,6,3,0,
    0,0,0,0,8,12,4, 45
5E  547 DATA 0,0,0,0,0,15,0,0,3,
    12,24,24,24,24,27,30, 183
72  548 DATA 1,3,5,1,1,1,1,1,3,1
    2,8,0,0,0,0,3, 40
03  549 DATA 7,8,0,0,0,3,0,0,0,0
    ,0,1,3,4,6,12, 44
04  550 DATA 0,0,0,0,0,0,0,0,48,
    48,116,152,0,0,0,0, 364
90  551 DATA 24,24,48,224,0,0,0,
    0,0,0,16,224,0,0,0,0, 560
3B  552 DATA 48,48,116,152,0,0,0
    ,0,192,0,32,192,0,0,0,0, 780
91  553 DATA 0,0,0,0,0,0,0,0,48,
    48,112,176,48,48,112,192, 78
    4
A2  554 DATA 48,48,48,48,0,0,0,0
    ,128,128,128,128,0,0,0,0, 70
    4
58  555 DATA 96,96,96,96,96,96,9
    6,192,32,32,16,16,0,0,0,0, 9
    60
DC  556 DATA 0,0,64,128,0,0,0,0,
    140,140,140,140,0,0,0,0, 752
9F  557 DATA 48,48,48,48,0,0,0,0
    ,48,48,96,192,0,0,0,0, 576
DE  558 DATA 48,48,48,192,0,0,0,
    0,48,48,112,176,48,52,56,48,
     924
EF  559 DATA 0,0,0,0,0,0,0,0,224
    ,48,48,224,0,0,0,0, 544
C8  560 DATA 0,0,64,128,0,0,0,0,
    48,48,52,216,0,0,0,0, 556
8C  561 DATA 96,192,192,128,0,0,
    0,0,216,216,120,48,0,0,0,0,
    1208
EE  562 DATA 128,192,96,48,0,0,0
    ,0,96,192,128,128,128,0,0,0,
     1136
F0  563 DATA 128,0,0,240,0,0,0,0
    ,24,24,48,192,0,0,0,0, 656
36  564 DATA 128,128,128,192,0,0
    ,0,0,0,0,0,248,0,0,0,0, 824
9A  565 DATA 24,24,48,224,0,0,0,
    0,96,248,96,96,0,0,0,0, 856
90  566 DATA 3,12,24,24,24,0,0,1
    ,1,3,3,2,6,6,4,15, 128
73  567 DATA 63,24,24,24,24,31,2
    4,24,7,14,24,48,48,48,48,48,
     523
C8  568 DATA 63,24,24,24,24,24,2
    4,24,63,24,24,24,24,31,24,24
    , 469
81  569 DATA 63,24,24,24,24,31,2
    4,24,3,14,28,48,48,48,48,48,
     523
CE  570 DATA 60,24,24,24,24,31,2
    4,24,3,1,1,1,1,1,1,1, 245
C9  571 DATA 3,0,0,0,0,0,0,0,60,
    24,24,25,27,30,30,27, 250
B9  572 DATA 30,12,12,12,12,12,1
    2,12,48,56,60,54,51,49,48,48
    , 528
0F  573 DATA 28,12,14,14,13,13,1
    2,12,3,12,24,24,24,24,24,24,
     277
13  574 DATA 31,12,12,12,12,15,1
    2,12,3,12,24,24,24,24,24,24,
     277
56  575 DATA 63,24,24,24,24,31,2
    7,25,7,12,12,12,12,7,1,0, 30
    5
75  576 DATA 31,16,1,1,1,1,1,1,6
    0,24,24,24,24,24,24,24, 281
31  577 DATA 56,24,8,12,12,4,6,6
    ,120,48,48,48,48,49,25,27, 5
    41
F8  578 DATA 120,48,24,12,6,3,3,
    7,56,24,12,6,3,1,1,1, 327
D6  579 DATA 31,16,0,0,0,1,3,6,7
    ,6,6,12,12,15,8,0, 123
C9  580 DATA 3,6,12,12,12,15,12,
    12,15,8,0,0,0,0,1,1, 109
1D  581 DATA 3,6,12,12,6,7,12,24
    ,7,12,24,24,24,12,7,0, 192
1A  582 DATA 128,128,128,128,0,1
    28,128,0,48,16,24,28,0,0,0,0
    , 884
B0  583 DATA 24,24,48,224,0,0,0,
    0,0,8,16,224,0,0,0,0, 568
70  584 DATA 48,96,224,192,0,0,0
    ,0,0,0,16,240,0,0,0,0, 816
D1  585 DATA 0,0,0,0,0,0,0,0,24,
    24,48,224,0,0,0,0, 320
BF  586 DATA 48,48,48,120,0,0,0,
    0,128,128,128,192,0,0,0,0, 8
    40
C7  587 DATA 192,192,192,128,0,0
    ,0,0,128,192,96,248,0,0,0,0,
     1368
6B  588 DATA 0,0,16,240,0,0,0,0,
    12,12,12,30,0,0,0,0, 322
50  589 DATA 112,112,48,56,0,0,0
    ,0,24,24,48,192,0,0,0,0, 616
01  590 DATA 0,0,0,0,0,0,0,0,152
    ,88,48,208,12,0,0,0, 508
FD  591 DATA 128,192,96,240,0,0,
    0,0,24,24,24,240,0,0,0,0, 96
    8
72  592 DATA 128,128,128,192,0,0
    ,0,0,48,48,96,192,0,0,0,0, 9
    60
DF  593 DATA 64,192,192,128,0,0,
    0,0,120,56,24,24,0,0,0,0, 80
    0
1D  594 DATA 96,48,24,60,0,0,0,0
    ,128,128,128,192,0,0,0,0, 80
    4
59  595 DATA 0,0,16,240,0,0,0,0,
    24,24,48,224,0,0,0,0, 576
D4  596 DATA 24,24,48,224,0,0,0,
```

```
     0,0,0,0,0,0,0,0,0, 320
10   597 DATA 24,24,48,224,0,0,0,
     0,48,48,96,192,0,0,0,0, 704
F3   598 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,176,240,48, 464
F3   599 DATA 0,0,0,0,0,224,48,24
     ,0,0,0,0,0,224,16,0, 536
A0   600 DATA 48,48,48,48,48,176,
     240,48,0,0,0,0,0,192,96,96,
     1088
45   601 DATA 192,32,0,0,0,192,0,
     0,0,0,0,0,0,176,240,48, 880
4B   602 DATA 0,0,0,0,0,224,48,48
     ,0,0,128,128,0,128,128,128,
     960
B4   603 DATA 0,0,96,96,0,96,96,9
     6,0,0,0,32,64,128,192,64, 96
     0
BA   604 DATA 0,0,0,0,0,0,0,0,0,0
     ,0,0,0,120,140,140, 400
D8   605 DATA 0,0,0,0,0,224,112,4
     8,0,0,0,0,0,192,96,48, 720
43   606 DATA 0,0,0,0,0,192,48,48
     ,0,0,0,0,0,176,240,48, 752
34   607 DATA 0,0,0,0,0,192,32,0,
     0,0,0,0,0,224,48,0, 496
E1   608 DATA 0,0,0,128,0,0,0,0,0
     ,0,0,0,0,48,48,48, 272
E0   609 DATA 0,0,0,0,0,48,48,96,
     0,0,0,0,0,12,12,140, 356
72   610 DATA 0,0,0,0,0,48,96,192
     ,0,0,0,0,0,48,48,96, 528
64   611 DATA 0,0,0,0,0,240,96,19
     2,192,48,24,24,120,216,24,24
     , 1200
58   612 DATA 128,128,128,128,128
     ,128,128,128,192,48,24,24,24
     ,48,192,128, 1704
2B   613 DATA 192,48,24,24,48,224
     ,48,24,96,224,224,224,96,96,
     96,96, 1784
4C   614 DATA 0,0,0,0,0,0,0,0,24,
     24,12,7,0,0,0,0, 67
F3   615 DATA 24,24,30,27,0,0,0,0
     ,12,12,6,3,0,0,0,0, 138
CB   616 DATA 24,24,12,7,0,0,0,0,
     31,24,12,7,0,0,0,0, 141
00   617 DATA 3,3,3,3,0,0,0,0,24,
     24,12,7,0,0,8,7, 94
86   618 DATA 12,12,12,12,0,0,0,0
     ,1,1,1,1,0,0,0,0, 52
5D   619 DATA 0,0,0,0,0,0,4,3,6,6
     ,6,6,0,0,0,0, 31
F3   620 DATA 12,12,12,7,0,0,0,0,
     49,49,49,49,0,0,0,0, 239
BE   621 DATA 12,12,12,12,0,0,0,0
     ,12,12,6,3,0,0,0,0, 81
0B   622 DATA 12,12,14,13,12,12,1
     2,12,24,24,12,7,0,0,0,0, 166

81   623 DATA 12,12,12,12,0,0,0,0
     ,7,0,8,7,0,0,0,0, 70
10   624 DATA 6,6,6,3,0,0,0,0,12,
     12,6,3,0,0,0,0, 54
74   625 DATA 12,6,6,3,0,0,0,0,54
     ,54,60,24,0,0,0,0, 219
E6   626 DATA 1,3,6,12,0,0,0,0,2,
     3,1,1,1,3,3,6, 42
B0   627 DATA 1,3,6,15,0,0,0,0,24
     ,24,12,3,0,0,0,0, 88
4B   628 DATA 1,1,1,3,0,0,0,0,7,1
     2,24,31,0,0,0,0, 80
9B   629 DATA 0,0,8,7,0,0,0,0,24,
     31,0,0,0,0,0,0, 70
99   630 DATA 224,48,24,24,24,48,
     192,128,128,192,192,64,96,96
     ,32,240, 1752
0A   631 DATA 192,96,48,48,96,224
     ,48,24,224,16,8,0,0,0,0,0, 1
     024
5B   632 DATA 192,224,96,48,48,48
     ,48,48,240,16,0,0,64,192,64,
     0, 1328
7C   633 DATA 240,16,0,0,64,192,6
     4,0,224,48,24,0,0,0,0,120, 9
     92
E6   634 DATA 120,48,48,48,48,240
     ,48,48,192,128,128,128,128,1
     28,128,128, 1736
78   635 DATA 240,192,192,192,192
     ,192,192,192,240,96,192,128,
     0,0,0,0, 2240
20   636 DATA 0,0,0,0,0,0,0,0,12,
     28,60,108,204,140,12,12, 576

BB   637 DATA 120,48,48,48,48,48,
     176,176,192,48,24,24,24,24,2
     4,24, 1096
AA   638 DATA 224,48,48,48,48,224
     ,0,0,192,48,24,24,24,24,24,2
     4, 1024
A5   639 DATA 192,96,48,48,96,192
     ,0,128,192,96,48,0,0,192,224
     ,48, 1600
8F   640 DATA 248,136,128,128,128
     ,128,128,128,120,48,48,48,48
     ,48,48,48, 1608
CB   641 DATA 28,24,16,48,48,32,9
     6,96,30,12,12,12,12,140,152,
     216, 974
DC   642 DATA 60,24,48,96,192,128
     ,128,192,60,24,48,192,128,12
     8,128,128, 1704
8E   643 DATA 240,48,96,192,192,1
     28,0,0,240,16,0,0,0,224,48,2
     4, 1448
BC   644 DATA 224,16,0,0,0,224,48
     ,24,240,48,48,96,64,192,128,
     128, 1480
BF   645 DATA 192,96,48,48,96,224
     ,48,24,192,96,48,48,48,48,24
     0,48, 1544
FA   646 DATA 1,1,1,1,0,1,1,0,12,
     8,24,56,0,0,0,0, 106
51   647 DATA 24,24,24,63,0,0,0,0
     ,48,24,14,7,0,0,0,0, 228
84   648 DATA 24,24,24,63,0,0,0,0
     ,24,24,24,63,0,0,0,0, 270
8B   649 DATA 24,24,24,60,0,0,0,0
     ,48,24,14,7,0,0,0,0, 225
1D   650 DATA 24,24,24,60,0,0,0,0
     ,1,1,1,3,0,0,0,0, 138
EB   651 DATA 0,0,8,7,0,0,0,0,25,
     24,24,60,0,0,0,0, 148
26   652 DATA 12,12,12,31,0,0,0,0
     ,48,48,48,120,0,0,0,0, 331
94   653 DATA 12,12,12,30,0,0,0,0
     ,24,24,12,3,0,0,0,0, 129
B6   654 DATA 12,12,12,30,0,0,0,0
     ,25,24,12,3,0,0,0,0, 130
7D   655 DATA 24,24,24,60,0,0,0.0
     ,0,12,12,7,0,0,0,0, 163
BF   656 DATA 1,1,1,3,0,0,0,0,24,
     24,12,7,0,0,0,0, 73
9F   657 DATA 2,3,3,1,0,0,0,0,30,
     28,24,24,0,0,0,0, 115
74   658 DATA 6,12,24,120,0,0,0,0
     ,1,1,1,3,0,0,0,0, 168
92   659 DATA 6,12,24,31,0,0,0,0,
     0,0,8,7,0,0,0,0, 88
46   660 DATA 12,12,6,3,0,0,0,0,3
     ,6,6,6,0,0,0,0, 54
DB   661 DATA 24,24,12,7,0,0,0,0,
     0,0,8,7,0,0,0,0, 82
AF   662 DATA 159, 159
```

PROGRAM: DBLPRINT DEMO

```
87   10 REM DBLPRINT SAMPLE SETUP

BF   20 SYS49152
8D   25 REM CAPITALS [CTRL D] & S
     HIFT KEY
3D   30 PRINT"[CLR,CYAN] [REV D,S
     D,SO,SU,SB,SL,SE] [SP,SR,SI,
     SN,ST] [SS,SA,SM,SP,SL,SE]"
14   35 REM RESET TO NORMAL [CTRL
      N]
8B   40 PRINT"[REV N,DOWN]ALL CUR
     SOR & COLOUR CONTROLS ARE US
     EABLE";
FC   50 PRINTSPC(4)"& ONLY MOVE A
      STANDARD DISTANCE."
6F   55 REM CAPITALS [CTRL D] & S
     HIFT KEY
CD   60 PRINT"[REV D,DOWN,SA,SB,S
     C,SD,SE,SF,SG,SH,SI,SJ,SK,SL
     ,SM,SN,SO,SP,SQ,SR,SS,ST,SU,
     SV,SW,SX,SY,SZ]"
EE   65 REM LOWER CASE [CTRL D] W
     ITHOUT THE       SHIFT KEY
B8   70 PRINT"ABCDEFGHIJKLMNOPQRS
     TUVWXYZ"
75   80 PRINTTAB(9)"[DOWN]1234567
     890?"
34   90 PRINTTAB(9)"[REV N,CY22]"

A8   95 REM STANDARD LOWER CASE
07   100 PRINTCHR$(142)"  BOTH EX
     ISTING CHARACTERS SETS CAN B
     E[SPC3]MIXED WITH DOUBLE".
23   110 PRINT" PRINT BUT NOT ON
     THE  SAME LINE";
F0   120 PRINT" '[ST,SA,SB](X) $
     [SS,SP,SC](X)' ALSO WORK."
C5   130 PRINT:PRINTCHR$(14)"[RVS
     ON]!WARNING! SOFTWARE CHANGE
     S IRQ. & OUTPUTVECTORS.";
FF   140 PRINT"[RVSON] HIT 'RUN/S
     TOP & RESTORE' BEFORE LOAD,S
     AVE & LIST ETC:[RVSOFF]";
55   150 PRINTSPC(1)"[RVSON]'←'TO
      ESCAPE.(C)[HOME]"
45   160 GETA$:IFA$<>"←"THEN160
C9   165 REM CAPITALS [CTRL D] &
     SHIFT KEY
D1   170 PRINT"[CLR,CYAN] [REV D,
     SD,SO,SU,SB,SL,SE] [SP,SR,SI
     ,SN,ST] [SS,SA,SM,SP,SL,SE]"

1F   180 PRINTTAB(7)"[REV N]DOUBL
     E PRINT ALSO SCROLLS"
42   190 PRINTTAB(7)"[RVSON]PRESS
      ANY KEY TO CONTINUE"
87   200 GETA$:IFA$=""THEN200
59   210 PRINTCHR$(4):FORN=65TO90
     :PRINTCHR$(N)CHR$(17);:NEXT:
     PRINT
F5   220 PRINT"[CYAN,RIGHT,REV D,
     SD,SO,SU,SB,SL,SE] [SP,SR,SI
     ,SN,ST] [SS,SA,SM,SP,SL,SE]"

CB   230 PRINTTAB(12)"GOOD BYE"
BC   240 PRINTTAB(11)"[REV N,SJ,S
     C16,SK]"
```

PLEASE NOTE: TO ENTER [REV D] & [REV N] HOLD DOWN CTRL AND PRESS THE LETTER

Contributions

So you own a Commodore? So you've written some programs? So why haven't you sent them to us?

Your Commodore is always on the look out for new programs, hints and tips, articles and even regular series. In fact if you have something that you think could be of use to other Commodore owners we want to hear about it.

So if you have got something which you think we may be interested in. How do you go about submitting it to us?

Below you will find a list of guidelines that will help us to deal with any item that you send in to us. We don't expect everybody to be the next William Shakespeare but if you do follow these simple rules then it will make our job a lot easier.

1) If possible all material sent to the magazine should be typed or printed out on a computer printer.

2) All text should be double spaced i.e. there should be a blank line between each line of text. You should also leave a margin of about 10 characters around the text.

3) On the very first page you should put the following:

- Name of the article
- Machine that it is for
- Any extras required – disk, printer etc.
- Your name
- Your address
- Your telephone number

4) The top of every page should have the following information on it:

- Abbreviation of the article title
- Your name
- The page number

For example, suppose you had submitted an article on C64 interrupts. You should put something like the following at the head of the page:

Interrupts/J.Smith/1

5) Please make sure that you do not make any additional marks on your text especially underlining.

6) Try and write in clear concise English, it does not have to be a work of literature but it must be comprehensible.

7) On the bottom of each page you should put the word MORE if there are more pages to the article or ENDS if it is the last page.

8) If possible, enclose a listing of all programs.

9) Under no circumstances use a staple to hold the pages together. Use a paperclip instead.

10) Programs should be included on either disk or tape. Make sure that you SAVE two copies of every program so that we have a better chance of loading them if problems occur.

11) Programs under 10 lines can be included in the text. If your program is longer than this you must enclose a disk or cassette.

12) If your article needs any artwork then supply clear examples of what is needed. We don't expect you to be an artist but we do need to see what is required.

13) Photographs, if necessary, must be either black and white prints or colour slides. We can take shots ourselves so don't worry about this too much.

14) Submissions of any length are welcome. If you have a five line routine that you think may be of use to someone else we welcome it just as much as a full blown six part series.

15) Payment varies quite a lot and depends on quite a number of factors, such as complexity of program, presentation of program, number of magazine pages it takes up etc. Payment is generally between £10.00 and £800.00.

16) All payments are made in the month that the magazine containing your article has appeared in print.

17) If we do find your submission suitable for inclusion in the magazine we will write to you giving the terms of publication, the rate of payment and an agreement form. Prompt return of this form will allow us to use your program as soon as possible.

18) If you want the program returning to you, should we find it unsuitable for publication, then you should enclose a stamped self addressed envelope.

19) The last and most important point to make is 'get writing', we are waiting for your articles. YC

Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10    :LN=70    :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one another out are so remote that we believe our listings are more reliable than any other magazine in the world. So get typing! YC

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]	£	
[LARROW]	←	
[UPARROW]	↑	
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

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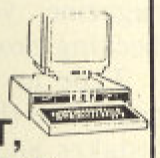
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B R E A K

Oops!

There is a slight correction required in our Hex Date Entry program, published March 1987 *Your Commodore*. This only needs to be changed if the start address ends in a one eg 0801. Line 665 at present reads:

CH=CH+CA-8

The correct version should in fact be:

CH=CH+CA-9

We hope that this will sort out any problems which you may have encountered whilst using this listing.

Adrian Antics



The Growing Pains of Adrian Mole, is not only a popular book and TV series it is doomed also to enter the world of computer games published by the Virgin Games. If you're already currently experiencing the hell on earth, affectionately known as your teens, then you may find a lot to identify with in this comedy game. If you left this phase of your life behind a long time ago, then it may serve to refresh your memory.

The game has been programmed by Level 9 in conjunction with Mosaic Publishing and will be available for the C64/128 at £9.95.

This month we've decided to run a caption competition in connection with Adrian's growing pains so have a good look at the accompanying picture (published courtesy of **Thames Television**) and see if you can come up with an apt witty caption to describe Adrian's obvious domestic bliss. The best caption will win £5.

Bug Finder

At *Your Commodore*, we try to publish high quality programs that are of benefit to as many readers as possible. This generally means that the programs are often very large and can be prone to typing errors. In order to make your life a little easier, we run a Bug Finder service.

If you have typed in one of our programs and despite much checking, you still can't get the program to run, then send us the following:

Two copies of your program on tape or disk.
A description of your problem.
If possible, a listing of your work (you may omit this).
A stamped, self addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

We will try to point out where you have made any errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

Do not send a program to us as soon as it stops working. Check it yourself first, if you don't, it only wastes valuable time that could be spent working on the magazine.

We do get a large number of queries in the office, so it may take a little time for yours to be processed.

Note: We can only deal with problems concerning programs published in *Your Commodore*.

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